

Agriculture



PUBLISHED 6^d MONTHLY

Lessons from the Counties



Reproduced from the original by permission of THE COUNTRYMAN LTD

Varieties of soils cause a diversity of scene in this curiously-shaped county with its many different products—motor cars and Masters of Arts, ironstone and Banbury Cakes. Contrast the deep, dark soils of the river valleys with the shallow limestone brash of the Cotswolds, or the retentive clays of the

east with the hungry lias sands of the north.

Yet there is grassland in all parts, and all of it requires skilled management—and nitrogen—if food production is to keep pace with the needs of the rising population. Nitrogen is the vital factor for increased output.

IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1



Please mention the JOURNAL when corresponding with Advertisers

TRACT CONTINENTAL

the new POWER on the land



C.B. 70 h.p.
Massive power. Impressive performance. Economical. Easy to handle.

C.B. 60 h.p.
For use on heaviest land. Has exceptional adhesion and stability. Drawbar pull of 15,250 lbs. (as illustrated).

C.D. 40 h.p.
Efficient medium sized tractor. Two sizes. 5 ft. 1 1/2 in. wide and 3 ft. 1 1/2 in. wide.

C.B. 30 h.p.
Unique in its compactness and power. Narrow gauge only 2 ft. 9 in. wide. Wider model 3 ft. 6 in.

"TRACT CONTINENTAL" stands for reliable power. The Track design follows that of all models of the "Continental", and allows for complete tracks or individual pins and bushes to be readily removed in the field without any special equipment. Nothing has been overlooked in the design and construction of these tractors.

Write for full details and name of our authorised Dealer in your area.

CONTINENTAL TRACTOR (Gt. Britain) LTD., Faggs Road, Feltham, Middlesex

Cables: Tracteur, Feltham

Telephone: Feltham 3045 (5 lines)

Manufactured by Richard Frederics of Leyton

Please mention the JOURNAL when corresponding with Advertisers



No seams

TO LEAK
OR CRACK

DUNLOP *Best on Earth*

Visit the DUNLOP STAND

ROYAL HIGHLAND SHOW, JUNE 28-29
ROYAL OXFORD SHOW, JULY 4-7

Dunlop Rubber Co. Ltd. (Footwear Division), Speke, Liverpool.

GF/MH/12

McCORMICK
INTERNATIONAL
Baler Twine
TREATED WITH SPECIAL REPELLENT, SOILS DON'T PENETRATE
DO NOT REMOVE WRAPPER BE SURE STARTING END
DRAWN FROM SMALL HOLE AT TOP OF BALE
TO CONNECT BALES
PLACE BALE BY SIDE
TO CONNECT
BALES PLATES
ONE ABOVE
THE OTHER IN
TWINE LINE
REVERSE
POSITION
FOR
EVEN
BALES
INTERNATIONAL
HARVESTER

**HOW TO secure A
PERFECT BALE ...**

Insist on McCormick International Baler Twine
• Treated for protection against mildew, rot, insects
and rodents • Treatment does not colour twine, or affect
natural aroma of hay • Runs freely without tangling
• Runs out smoothly to the last foot • Perfectly wound
and wrapped for easy loading, threading and joining.

Supplied in 2-spool bags by your IH Dealer

INTERNATIONAL

INTERNATIONAL HARVESTER CO. OF GREAT BRITAIN LTD.
"Harvester House," 258, City Road, London, E.C.1



HARVESTER

Works: Wheatley Hall Road, Doncaster
Orrell Park, Bootle, Liverpool

IF IT'S AN
I MACHINE
IT'S A REAL
INVESTMENT

Please mention the JOURNAL when corresponding with Advertisers



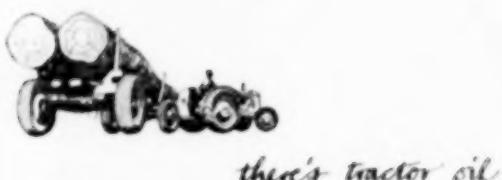
You can't expect production by just
asking for it ; workers need to be fed,
and fed well. Cows are just like humans
in this respect, but it's a good deal easier
to satisfy their needs. It's all
in a couple of words - Feed Silcocks

B. SILCOCK & SONS LTD - STANLEY HALL - EDMUND STREET - LIVERPOOL

Please mention the JOURNAL when corresponding with Advertisers



LEADERSHIP
IN LUBRICATION



Good lubrication is vital to the life of your tractor. The Shell Organisation — whose Thornton Research Centre, the biggest in Britain, is experimenting constantly to produce the right grade of lubricating oil for every purpose — is best equipped to produce the lubricating oil exactly suited to your tractor's needs. That's why you should always use SHELL TRACTOR OIL.

SHELL TRACTOR OIL

Books on

Agriculture and Allied Sciences of all publishers supplied from stock. Catalogue of Works on Agriculture and Horticulture available.

Scientific Lending Library New Books and latest editions obtainable.

ANNUAL SUBSCRIPTION, TOWN or COUNTRY, from ONE GUINEA

Second-Hand Books
140 GOWER STREET, W.C.1

Large Stock of recent editions
Back volumes of Scientific Journals
Old and Rare Scientific Books

H. K. LEWIS & Co. Ltd.
LONDON 136 Gower St., W.C.1
Telephone: EUSTON 4282 (5 lines)

COPPER COMPOUNDS

In Agriculture

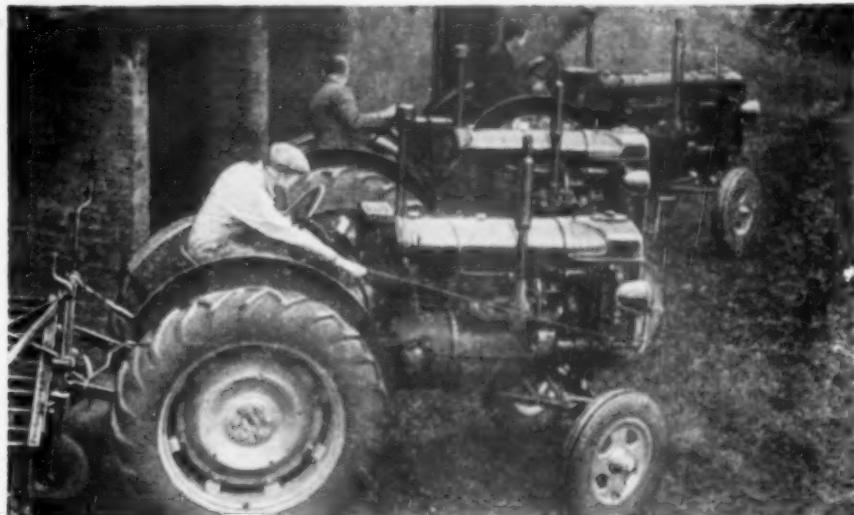
This C.D.A. book deals with the prevention of the loss of potatoes due to blight. It also surveys the uses of copper compounds in protecting certain other crops from fungus diseases and in combating 'deficiency diseases' in plants and animals due to lack of copper in the soil. A copy may be obtained by any applicant genuinely interested, free of charge or other obligation. For this or any other information on the uses of copper, write to the Copper Development Association, Kendals Hall, Radlett, Herts. (Radlett 8616).



Please mention the JOURNAL when corresponding with Advertisers

A NEW 'MONEY SAVER' FOR Fordson Major Owners

*Adjustable Vaporiser saves warming
in time—STEPS UP EFFICIENCY*



HERE'S another great 'Money Saver' for Fordson Major owners. It's a new type Vaporiser now being fitted to all new Majors, which is adjustable to meet different temperature conditions. The result is a fast easy start—even on cold mornings, quick warming up, a quicker change over from petrol to vaporising oil and still lower lubricating oil dilution. Prolonged idling periods without use of the choke also become more practicable. All these things inevitably add up to a saving of fuel over a season's operation. In time saved alone, this new Vaporiser will pay for itself over and over again.

See your dealer about fitting

The new Vaporiser can be easily, quickly and inexpensively fitted by your local Fordson Tractor Dealer. Call and ask him to tell you more about it and how it can save you time and money!

Another Big Advantage of Fordson Farming

When your Major's engine shows signs of wear after long hard use, you can exchange it for a 'Good as New' Replacement unit direct from the Ford Factory—thereby giving your Major *many extra years of useful life*. A Replacement Engine costs only £29 at Dealer's Depot—plus a small fitting charge*. From whatever angle you look at it you gain by Farming with a Fordson.

Fordson
MAJOR TRACTOR

FORD MOTOR COMPANY LIMITED DAGENHAM

★ Visit Stand 304 • Avenue 10 • Block D
at the Royal Show, Oxford, July 4-7

Please mention the JOURNAL when corresponding with Advertisers

ONE OF THE MOST
COMPLETELY EQUIPPED
TRACTORS ON THE
MARKET

Compare any
Tractor Specification
with these features

ENGINE. Unique bi-fuel carburettor for Petrol or V.O. or combined Petrol-V.O. operation, eliminating fuel wastage and minimising carburetor dilution. No necessity to drain fuel bowl. Full power from fuel by extreme accuracy of manifolding and carburation. 12 volt, electric starting standard. Battery fully insulated from vibration and protected by special voltage regulator. Instantaneous response governor, controlled by unique hydraulic dash pot, in continuous flow lubrication, guarantees unvarying engine performance.

HYDRAULIC LIFT. Two lever control provides independent operation of front, middle and rear mounted or trailed equipment. Large oil capacity for efficient operation of hydraulic cylinders on equipment or implements. Longer implement life achieved by adjustable rate of lowering and automatic anti-crash valve. Oil to lift unit is twice filtered. Linkage takes greatest possible variety of three-point hitch implements. Linkage can be removed from tractor in less than a minute. Drawbar remains in position when mounted equipment is in use. Complete lift unit fitted to tractor in two hours.

GENERAL. Sturdy frame construction guarantees extreme strength and correct alignment. Easy change from three to four wheels and vice versa greatly increases working time and versatility. Time and money further saved by ease and speed with which optional equipment may be fitted when required. Intelligent grouping enables all controls to be operated from driver's seat. Real driver-comfort and finger-light controls eliminate fatigue. Grouped accessible maintenance points for complete, quick service. Mounting pads for implements, etc., provided on sides and rear of main frame and on rear axle castings. Gearbox and differential being housed in a single casting, ensures accurate meshing of gears and silent, long life. Oil changes at 1,000 hour intervals. Transmission designed to withstand extra stresses of Diesel engine.

Write for details of UNIT REPLACEMENT

*SCHEME guaranteeing speedy repairs to
Nuffield Universal Tractors through
accredited Distributors and Dealers.*

Model M4
4-wheeled
Basic Tractor
£490



MORRIS MOTORS LTD. (AGRICULTURAL DIVISION),
COWLEY, OXFORD

Overseas Business
NUFFIELD EXPORTS LTD., OXFORD AND 41, PICCADILLY, LONDON, W.I.



Please mention the JOURNAL when corresponding with Advertisers

AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Editorial Offices: St. Andrew's Place, Regent's Park, N.W.1 (Phone: WELbeck 7711)

VOL. LVII

No. 3

JUNE 1950

- * Provided that the source is acknowledged in each instance, such articles and notes as are published in this Journal without any specific reservation regarding copyright may be reproduced in any registered newspaper or public periodical without special permission. The Ministry does not accept responsibility for statements made, or views expressed, in signed contributions to this Journal or in those reproduced from another source.
- * Further, the Ministry does not accept responsibility for any of the private and trade advertisements included in this publication.
- * All communications respecting advertising in the Journal should be addressed to the Advertisement Contractors, Aldridge Press, Ltd., 15 Charterhouse Street, London, E.C.1. Telephone: Holborn 8655.

Contents

Page

Recent Advances in Grassland Efficiency. Sir William Gavin	101
Marginal Land Reclamation at Mixon Hay. H. E. Wells	106
Some Infectious Diseases of Dairy Stock. J. C. Buxton	112
Twenty Years of Farming in West Somerset. R. T. Clarke	118
Meat and Milk from a Yorkshire Moorland Farm. T. C. Creyke	124
Adapting Home-made Dusting Machines for Use on Tractors fitted with Hydraulic Lifts. L. J. Churchill	128
The Control of Whiptail in Broccoli and Cauliflower. William Plant	130
Colorado Beetle in England, 1949. C. T. Gimingham and J. Thomas	134
Farming Affairs	137
Agricultural Statistics: England and Wales	141
Beekeeping Statistics, 1948-49	145
Book Reviews	147

Cover Photograph

West Somerset from the Brendon Hills

Mustograph



The 1950 ROYAL SHOW IS AT OXFORD

July 4th, 5th, 6th, 7th

Farm Implements and Machinery • Horses
Cattle • Pigs • Sheep • Goats • Poultry
Heavy Horse Turnouts • Jumping • Flower
Show • Forestry Exhibition • Bee Keeping
Fleece Exhibits • Cider and Perry Exhibits
Tractor Parade • Young Farmers' Competi-
tions • Rural Industries • Advisory Services

Secretary: *Alec Holson, O.B.E.*
ROYAL AGRICULTURAL SOCIETY OF ENGLAND
16, BEDFORD SQUARE, LONDON, W.C.1.
Telegrams: Practice, Phone, London Telephone Museum 7901



Be sure and visit
**THE
MINISTRY OF AGRICULTURE
EXHIBIT**

Stand No. 711

Avenue 16

Block E



Cropping and Stocking a 250-acre farm for the 1952 objective

Crop Rotations • Livestock Demonstrations (cattle and pigs)

Water Supply • Weed Control • Grassland Management

Feeding Silage • Animal Health • Grain Handling and Storage

AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

VOL. LVII

No. 3

JUNE 1950

RECENT ADVANCES IN GRASSLAND EFFICIENCY

SIR WILLIAM GAVIN, C.B.E.

IN the national drive for increased agricultural production, attention has rightly been centred on the improvement of grassland. This is because (a) the area of grassland is so great—approximately equal to all tillage crops put together—and (b) because new knowledge and methods of cultivation, grazing and conservation make a very great increase possible. Whereas the standard of tillage farming is such that an all-round increase of 10 per cent in crop yields would be a very great achievement, there are immense areas of grassland where increases of 50, 75 or 100 per cent are easily attainable. Even a modest increase of 30 per cent, which is far below the possibilities, would represent feedingstuffs worth £66 million at 1947 unsubsidized prices, and probably some £100 million today—a startling contribution to import-saving.

Much progress towards better grassland has already been made. Many factors are involved, most of which are well known to progressive farmers, such as better varieties and strains of seeds, better pasture cultivations by harrowing and topping, better control of grazing, special-purpose seeds mixtures to provide more continuous grazing throughout the summer, "staggering" of new seed-leys by sowing some with a nurse crop and some direct, suitable applications of nitrogenous fertilizers to give early and late bites, increased conservation as silage and dried grass, and earlier and better quality hay. These developments are widely known if, as yet, insufficiently widely practised. Further knowledge is accumulating rapidly and interesting papers have recently been published on many of these aspects, and while space does not allow them to be discussed in detail, I hope the following brief notes will lead those interested to the original papers or to further thought and experiment on their own farms.

Controlled Grazing. An article in this JOURNAL by Castle and Foot⁽¹⁾ describes the close-folding of dairy cattle with the electric fence, more particularly the "fore-and-aft" system, where a fence behind as well as in front of the cows prevents them fouling the newly growing herbage on the ground already fed. Useful diagrams are given showing how the difficulty of watering can be overcome. The advantages of this system are evident. The daily intake can be rationed, thus avoiding the alternatives of over-feeding and under-feeding that are inseparable from ordinary field practice. Fouling of the uneaten herbage by dung and urine is reduced to a minimum, as also is selective grazing of the palatable species, resulting in encouragement of the less nutritious species. Similar advantages attach to the daily-folding of marrowstem kale in winter, where the selective grazing applies to the leaves as opposed to the stems.

Some practical results of "fore-and-aft" grazing are given by Dedman⁽²⁾: in one case 380 gallons of milk per acre for the first grazing of a ryegrass ley; in another 500 gallons per acre for two grazings; in another 80 cow-days

RECENT ADVANCES IN GRASSLAND EFFICIENCY

per acre from old grass following a heavy silage crop ; and lastly 160 cow-days per acre from poor old grass under severe drought conditions. Recent work at Jealott's Hill Research Station⁽³⁾ gives some indication of the underlying reasons for these and other remarkable results. In a trial comparing close folding of dairy cows with rather intensive rotational grazing, it was estimated that with close folding the cows consumed 2,331 lb. of starch equivalent against 1,808 lb. with rotational grazing (April 19-August 14). During this period the milk yields per acre were 487 and 387 gallons respectively. Had the comparison been made with ordinary field-to-field grazing, the differences would doubtless have been even more striking. These workers concluded that the better utilization of herbage—about 25 per cent—was largely due to the greater avoidance of fouling by dung and urine. As the season progressed, utilization by both methods fell as follows :

	<i>Close Folding</i>	<i>Rotational Grazing</i>
First Grazing	81 per cent utilized	69 per cent utilized
Third Grazing	55 per cent utilized	43 per cent utilized

Clearly we are at the very beginning of developments in the far better utilization of herbage by the grazing animal.

High-level Fertilization of Grassland

Several recent papers have dealt with the high-level fertilization of grassland⁽⁴⁾. One such paper was read to the Fertiliser Society in February this year⁽⁵⁾ by Hamilton, who pointed out that it is still largely unrealized what a tremendous response can be obtained from grassland if it receives adequate fertilizer treatment on the scale commonly accorded to other heavy-yielding crops such as mangolds, sugar beet and potatoes. The following table taken from this paper shows estimated quantities of plant nutrients* lost under varying systems of grass management. It will be seen how striking is the difference in fertilizer losses according to how the grassland is used :

YIELD LEVEL OF GRASS AND HOW USED	NUTRIENTS LOST EXPRESSED AS FERTILIZERS			
	"Nitro Chalk" 15.5% N	Super-phosphate 18% P ₂ O ₅	Muriate of Potash 50% K ₂ O	Lime CaCO ₃
<i>Grazed by adult fattening cattle, yielding:</i>				
40 cwt. dry matter per acre	0.3	0.07	0.12	0.05
60 cwt. dry matter per acre	0.6	0.14	0.24	0.10
90 cwt. dry matter per acre	0.9	0.21	0.36	0.15
<i>Partly grazed by dairy cows and young stock and partly eaten indoors as hay and silage</i>				
30 cwt. dry matter per acre	2.9	0.5	0.7	0.4
60 cwt. dry matter per acre	5.8	1.0	1.4	0.8
90 cwt. dry matter per acre	8.7	1.5	2.1	1.2
<i>All removed by cutting and sold off the farm:</i>				
30 cwt. dry matter per acre	5.4	1.5	2.1	1.1
60 cwt. dry matter per acre	10.8	3.0	4.2	2.2
90 cwt. dry matter per acre	16.1	4.5	6.3	3.3

* Expressed in terms of "Nitro Chalk" (15.5% N), superphosphate (18% P₂O₅), muriate of potash (50% K₂O) and lime (CaCO₃).

RECENT ADVANCES IN GRASSLAND EFFICIENCY

There are a few farmers who meet these requirements, who give up to 5 cwt. nitrogenous fertilizer per acre to their dairy grazing land every year and up to 8 cwt. per acre when successive cuts are taken for silage or grass drying, together with adequate phosphates, potash and lime. The great majority, however, whilst giving an occasional dressing of superphosphate and basic slag, fail to realize the urgent need for nitrogen. There is comparatively little grassland where dressings of 2 to 4 cwt. nitrogenous fertilizers *every year* will not give an economic return in quality and quantity of herbage, provided the other requirements are met.

Hamilton also gives three examples where the production from leys heavily treated with fertilizers (particularly nitrogen) has risen to 38, 41 and 53 cwt. starch equivalent per acre, compared with a national grassland average of about 12 cwt. The target of 30 per cent increase suggested earlier in these notes is thus a modest one; the examples just quoted represent increases of the order of 300-400 per cent.

Intensive Treatment of Permanent Grass

Hay(*) describes the high standard of grassland management in Holland leading to an intensity of stocking which seems almost incredible. He quotes one typical intensive holding of 45 acres carrying 27 cows (average yield 820 gallons), 20 followers and a few pigs and horses. 22 acres were cut for hay, 5 acres for silage and a few acres for dried grass. Other observers have given further examples, some of which are tabulated here :

FARM ACREAGE	LIVESTOCK				GRASS CONSERVED		
	Dairy Cows	Followers	Horses or Bulls	Others	Hay	Silage	Dried Grass
44 grass	38	—	5	Few calves	24	80	3½
50 grass	34	30	2	—	50	150	5
84 grass 7½ arable 22 grass	37	23	2	—	100	150	10-15
11*	5	—	1	—	20	30	—
72 grass	40	62	3	48 calves 91 sheep and lambs	50	100	10

* This farmer finds himself under-stocked and proposes to increase the number of his cows to 15. No feedingstuffs are purchased. Average fertilizer dressing is 9 cwt. nitrogen and 4 cwt. superphosphate. Tripod-made hay averaged 16 per cent crude protein.

This level of stocking makes one wonder if we have really begun to farm our grassland in this country. The amount of purchased feeding-stuffs on these farms, apart from some sugar beet pulp and wet grains where available, was almost negligible and in some cases nothing at all was purchased. In all cases milk yields were high (850-1,000 gallons). Only on one or two farms was there any evidence that the usual explanation of a high water-table was justified. Meticulous care in management, spreading or collecting droppings, removal of surplus grass at the right moment, controlled grazing, high and frequent application of nitrogen, combined with adequate supplies of phosphates, potash and lime—these were the factors,

RECENT ADVANCES IN GRASSLAND EFFICIENCY

secured in the main, it must be admitted, by long hours of family labour. Nevertheless such results surely hold some lessons for us in this country.

Cheapness of Grass Overriding all the foregoing considerations, however, and likely to be of increasing importance in the near future, is the cheapness of grass compared with other feedingstuffs. Here are some striking figures taken from Hamilton's paper referred to :

Source	Cost per ton of starch equivalent*
Grazing (utilized S.E.)	£ 5. 6 10
Grazing early bite (utilized)	10 0
Hay (produced)	15 0 with 2.7 cwt. protein equiv.
Grass silage (produced)	16 0 with 3.3 cwt. protein equiv.
Oats (do.) 20 cwt. crop	20 0
Mangolds (do.) 24 ton crop	30 0
Dairy cake at present price of £24	42 0 with 6.3 cwt.
Dairy cake at estimated unsubsidized price of £30	52 0 protein equivalent

* These figures are taken from average returns from 56 farms included in a Grassland Investigation Scheme undertaken by Imperial Chemical Industries in 1948, except that for mangolds which is taken from published data.

Since cheap grass is in the main produced by fertilizers, the new arrangements granting a price rebate on fertilizers used for grassland becomes of increased importance. New prices have not yet been announced and the figures that follow are no more than intelligent anticipation, but clearly for the ensuing year the cost of fertilizers for the production of grazing, hay, silage and dried grass will be less than before.

Let us take a general dressing of 2 cwt. sulphate of ammonia or other nitrogenous fertilizer, 3 cwt. superphosphate and 1 cwt. muriate of potash. At present prices this costs £2 10s. 9d. per acre. At the anticipated new prices, less one-third rebate, it looks like costing £2 1s. 8d. in 1950-51 and £2 10s. in 1951-52. It is clear that the fullest advantage should be taken of these special arrangements.

Conservation Recent advances in the production of silage are too well known to need more than passing reference here. Increased mechanization, notably the use of the buck-rake, and storage in pits instead of containers, has taken the backache out of the operation. Increased attention will doubtless be paid to the protein content of dried grass following Mr. Bevin's disclosure⁽¹⁾ that his firm had to reject 70 per cent of the samples offered, owing to low protein content (average of those offered 12 per cent). Earlier and better quality hay, gained by improved methods or greater attention, is also becoming more prevalent.

Management Thus the main directions in which greater efficiency can be looked for in grassland production can be summarized as :

- (a) better utilization of the herbage by close folding, preferably "fore-and-aft" by the electric fence;
- (b) production of more herbage by high-level fertilization, particularly with nitrogen;
- (c) increased production from permanent grass by the same intensive treatment as is given to leys;
- (d) increasing skill in conservation.

RECENT ADVANCES IN GRASSLAND EFFICIENCY

But all these aids to higher production must be accompanied by good management. It is waste to apply fertilizers if the extra grass produced is not fully utilized or if the sward is injured by faulty grazing at the wrong times. Heavy stocking calls for preventive measures against parasitic infection. When the herbage is lush, and particularly when clovers are abundant, the danger of digestive troubles and bloat must never be forgotten. Again, the same care must be given to grassland for conserving as for grazing: the quality of what comes out of the hayrick, the silo or the grass-drying plant depends on the quality of what goes in. Provided management is right, I believe that the increased productivity of grassland affords the great chance for agriculture to make a really large contribution to national recovery. It is certainly the only means whereby we can fulfil the task of increasing at the same time our livestock and our tillage acreage.

References

1. Close Folding of Dairy Cattle with the Electric Fence. CASTLE, M. E. and FOX, A. S. *Agriculture*, 1949, **56**, 1-6.
2. Grass and the Cow. DEDMAN, R. *The Home Farmer*, February, 1950.
3. The Close-Folding of Dairy Cows (Awaiting publication). PROCTOR, J., HODGKINSON, A. E. M., FERGUSON, W. S. and LEWIS, A. H.
4. See for example, Doubling our Grassland Yields. HOLMES, V. W. *Scottish Agriculture*, 1949, **28**, 205.
5. Role of Fertilizers in Increasing Output from Grassland. HAMILTON, R. A. *Proceedings No. 8, The Fertiliser Society*.
6. Self-Sufficiency in Holland, Denmark, and Sweden. HAY, W. D. *Agriculture*, 1948, **55**, 286-9.
7. Animal Feeding Stuffs : Prospects of Supply. BEVIN, F. J. Farmers' Club, April, 1950.

AGRICULTURAL INDEX NUMBER

MONTHLY INDEX NUMBERS OF PRICES OF AGRICULTURAL PRODUCTS
INCLUDING GOVERNMENT GRANTS. (BASE 1927-29=100)

Month	Uncorrected for Seasonal Variation					Corrected for Seasonal Variation				
	1939	1947	1948	1949	1950	1939	1947	1948	1949	1950
January	96	217	242	245†	264†	89	193	215	218†	215†
February	94	211	240	243†	258†	88	190	217	219†	232†
March	90	201	232	237†	248†	91	191	220	225†	234†
April	90	186	214	227†		95	192	222	237†	
May	82	171	198	208†		91	192	223	235†	
June	80	170	198	207†		89	193	225	236†	
July	85	181	199†	209†		93	197	217†	233†	
August	87	192	211†	224†		91	209	228†	244†	
September	93	206	210†	223†		93	223	227†	242†	
October	97	222	225†	242†		92	216	229†	244†	
November	107	235	239†	257†		98	217	229†	235†	
December	114	241	245†	264†		104	217	221†	235†	

† Provisional.

MARGINAL LAND RECLAMATION AT MIXON HAY

H. E. WELLS, B.Sc., N.D.A., N.D.D.

County Agricultural Officer, Staffordshire

MIXON HAY and the adjoining farm of Westbrook Head have been occupied by the Ministry of Agriculture since 1942, at first as an out-station to Sir George Stapledon's Grassland Improvement Station and latterly as a demonstration centre by the Staffordshire Agricultural Executive Committee. Both are about 200 acres in extent, lying between 1,100 and 1,500 feet on the Pennines, about four miles east of Leek. Apart from size—the vast majority of the farms in this region are about 50 acres in extent—they are typical of a large area in north Derbyshire, north-east Staffordshire and north-east Cheshire. Mixon Hay, the lower of the two, lies on the carboniferous limestone, while Westbrook Head is entirely on millstone grit. The former has a large stone-built farmhouse situated about a mile from the public road with solidly built cowsheds for 44 cattle, loose boxes and hay loft. Westbrook Head, at 1,400 feet, has a small house with a modern cowshed for 16 animals, and a few old stone buildings. There are no cottages. The general slope of the land on both farms is towards the south-west. Rainfall averages 50 inches a year; snow, which may be expected at any time from mid-October onwards, lies, in an average winter, for perhaps six weeks, though the period is very variable. High winds are prevalent, and in calm weather there is much cloud. Fields are divided by low, dry stone dykes in poor condition; there are no shelter belts, nor indeed any trees apart from a few around the larger homestead. Altogether it is a pretty bleak spot, and the local description of the climate as "nine months winter and three months cold weather," if sardonic, is not inapt.

There is, of course, practically no flat land; gradients, in general, are fairly easy, but nearly all the fields are broken by steep-sided gulleys; wheeled traffic moves, therefore, perforce by tortuous tracks, if it moves at all.

At the outset there was around each homestead an area of 10-20 acres of reasonably good pasture, closely grazed each season, which had doubtless received for many years the benefit of manurial residues from corn consumed by cattle and sheep. They carried a useful sward with some clover. A similar area of mowing land mucked each year and yielding a good cut of late but "herby" hay containing much ribgrass, sorrel and cow parsnip, was found on each farm. Away from the homesteads, pastures became progressively worse, passing out on the carboniferous limestone to thickly matted fescue and nardus; on the millstone grit land, to *agrostis*, tussocks, rushes, bilberry and eventually to heather on the highest and most remote fields.

Reclamation The plough has been the main agent in reclamation. During the earlier years of occupation a large proportion of the land was ploughed and brought into rotation or resown. Though no strict line of demarcation between rotation and resown land has been adopted, approximately 70 acres have been treated as in the former category, and about 40 acres have at all times been under tillage crops, while 250 acres out of the total 400 have been resown direct to permanent grass. Some knowledge of the technique and requirements of reclamation of such land by ploughing and direct resowing already existed in the district, for in the

MARGINAL LAND RECLAMATION AT MIXON HAY

'twenties Bond and Stickland had experimented on a variety of farms scattered throughout the Peak District, as Mercer and Carr had done in Cheshire. The war, however, brought new tools to ease the task ; the advent of the Aberystwyth and other strains of grasses and clovers greatly extended the possibilities of improvement.

Arable Crops Some 40 acres on the two holdings have been under tillage crops each season—approximately 25 acres to oats and 15 acres to roots, including potatoes for seed production. Numerous varieties of oats have been tried, and Black Supreme has consistently given the best results, threshing out at yields varying from 18 to 25 cwt. per acre. But in 1946 they had to be cut with a mowing machine and harvested loose, whilst in 1948 the last lot were not carted until late October. The risks and the cost of harvesting are great, so making cereal production at altitudes over 1,100 feet a very doubtful proposition, even during war time. Root growing, on the other hand, is a worthwhile business, particularly when reliance is placed on ox cabbage, kale (both marrowstem and thousandhead), rape and swedes. Cabbage and kale are relied upon to provide succulent fodder from October to the end of December, usually before starting on the silage. The swedes often find a ready market for human consumption as a vegetable ; otherwise they come in for cattle feeding from January until April. The growing of potatoes for seed has been reasonably satisfactory only one year in two, due primarily to the almost constant lashing of the haulm by wind—often at gale force. It is, moreover, a crop which does not fit in easily with the main policy of the farm, and the main operation of lifting frequently clashes with the period when all hands are mobilized in getting the last crop of silage.

Re-seeding : Selection of Land and Pre-treatment Nearly 150 of the 200 acres on Westbrook Head were, at the outset, more or less waterlogged. In this respect the farm

resembled many others in the area. Though a number of fields were ploughed out and resown either with a pioneer or, more hopefully, with a permanent mixture, our experience has made it abundantly clear that drainage of waterlogged soils, on millstone grit at least, is an essential pre-requisite to successful reseeding. Close drainage is, however, seldom called for. On Westbrook Head the problem of surplus water has, on many fields been solved by cutting open ditches across the slopes and laying a skeleton tile drainage system with 4-inch and 6-inch tiles to collect the spring water outcropping on the slopes. It is often necessary, in addition, to collect water from isolated pockets. By such skeleton methods a number of hopelessly waterlogged fields have been brought into reasonable condition at a total cost of £7 per acre (i.e., £3 10s. per acre net, after allowing for grant).

It has often been found necessary to carry out some surface cultivation before ploughing, particularly on bracken-infested land and on land carrying a heavy growth of tussock, rushes, nardus and molinia, or where ant-hills or overgrown mole-hills are abundant.

Bracken is best dealt with by destroying the frond during July with heavy disc harrows drawn by a crawler tractor. Twice over with the discs (once in each direction) at this time of year destroys the frond when it is at its maximum growth, having practically exhausted the food store in the root, and before the process of replenishment of that food store has begun. By adopting this practice and then ploughing the treated land in the following September, it is seldom that much bracken reappears in the resown

MARGINAL LAND RECLAMATION AT MIXON HAY

pasture ; stunted bracken does sometimes occur which, if topped off with the mowing machine in the following July, is destroyed completely.

Where the surface is very irregular or carries a heavy growth of tussocks and rushes, twice over with the heavy disc harrows, set keen, is usually all that is necessary to ensure that the ploughing can be done efficiently.

Ploughing and Liming The ploughing should be done as flat as possible with a single-furrow digger-type plough. The ideal depth is that which produces about 6 inches of workable soil ; if, for instance, there are 3 inches of mat, the plough should be set for 9 inches. Deep ploughing (i.e., 12-15 inches) is liable on this farm to bring up several inches of heavy clay, so producing a sticky, non-porous surface that poaches easily. Ploughing should be done in summer or autumn, depending on the degree of reversion and the conditions governing the application of lime. The golden rule seems to be that the worse the condition of the land the longer should be the interval between ploughing and seeding.

Where nardus and bilberry predominate the ploughing is best done during August and the lime applied immediately on to the newly ploughed surface whilst the land is dry enough to carry the lime spreader and the contractors have few orders on hand from more favourable districts. The automatic lime spreading service by suppliers is one of the greatest innovations of recent times and has solved perhaps the biggest problem of marginal land reclamation. After numerous trials with quantities of lime varying from 1 to 5 tons of ground limestone per acre, or its equivalent in the form of burnt lump or small lime, we have come to the conclusion that ground limestone applied on delivery in late summer and autumn at the rate of 4 tons per acre and allowed to soak into the soil thoroughly during the winter gives the best results and is the cheapest proposition.

Preparation of Seedbed As soon as the land is dry enough in the following spring the seedbed is prepared with a furrow press roller (10-furrow press rings mounted on to one shaft) and heavy disc harrows, set fairly straight, drawn in tandem by a crawler tractor. Three times over with this machinery, with an extra time or two along the open furrows, is usually sufficient to obtain a fine, firm seedbed. The main consideration at this stage is consolidation. There must be no cavity left below the furrow slice, particularly if the original sward was thickly matted. Rolling and discing must continue until such cavities have been eliminated. When a satisfactory seedbed has been obtained, the land is rolled with a Cambridge roller and then the small seeds are drilled along with 2 cwt. ammonia phosphate per acre, or its equivalent, by a combined corn drill set about $1\frac{1}{2}$ inches deep. Half the seeds mixture and half the fertilizer are drilled in one direction, the land is then rolled with a Cambridge roll and the remaining half of the seeds and fertilizers sown diagonally across the first drilling and the land finally rolled again. The drilling can be done any time from the end of March to the end of July, provided the ground is dry—the drier the better. We have never experienced a "take" failure with drilled seeds (and this applies not only to Mixon, but to thousands of acres seeded under this Committee's Contract Service throughout the county ; we continued drilling right through the long drought of 1949 up to the end of July with excellent results). Sowing of small seeds on the uplands *after* July is a gamble—the grasses come all right, but the early frosts usually destroy the clovers before they are properly established.

MARGINAL LAND RECLAMATION AT MIXON HAY

Seeds Mixtures Throughout the eight years under review a great variety of seeds mixtures has been used, partly in comparative trial plots and partly in whole-field trials, the mixtures ranging from simple pioneer seedings with short-duration strains (or even cleanings) to expensive mixtures composed largely of pedigree strains intended to provide permanent swards.

It is impossible in the space at my disposal here to describe results with these various mixtures or indeed to do more than to outline the main conclusions to be drawn from the eight years' experience. Perhaps the most informative of them all has been a trial at 1,400 feet on a millstone grit soil with one-grass, one-clover mixture. On thirty plots, which were mown and grazed in alternate years, combinations of the following were used :

Perennial ryegrass—commercial, N.Z. certified, S.24, S.101 and S.23.

Cocksfoot—commercial, N.Z. certified, Corstorphine 196, S.37, S.26 and S.143.

Timothy—commercial, S.51, S.48, S.50.

Meadow fescue—commercial, S.53.

Red clover—English broad, S.151, late-flowering English, N.Z. Montgomery S.123.

Alslke.

American mammoth red clover.

White clover—Dutch, N.Z. certified, S.100, wild white, Kent S.184.

All red clovers died out completely in the first two years after seeding. Alslke produced a fair growth for three years before dying out. All the white clovers, except Dutch, persisted well and still form an appreciable proportion of the sward, New Zealand certified and S.100 maintaining most luxuriant growth. Cocksfoot, S.143, S.26 and S.37 have proved outstanding, with little to choose between the three. After six years the sward of all three plots is, if anything, better and more productive than it was during the first two seasons. There are no signs of tuftiness or of dying out, and very little, if any, suppression of clover has taken place. Commercial cocksfoot and Corstorphine 196 are now very patchy and tufty, and much *agrostis* has come in. Clover was smothered out during the first two years. Of the ryegrasses, S.23 and New Zealand certified are still very satisfactory but considerable reversion has taken place on the other plots.

Timothy, S.48 and S.51 and meadow fescue S.53 have thriven well, producing swards with an excellent mixture of grass and clover, though, under the system of management adopted, yields have not been comparable with those from the leafy strains of cocksfoot and ryegrass.

The last observation notwithstanding, timothy S.48 and S.51 and meadow fescue, S.53 and S.215 have proved of immense value in the economy of the farm. On a neighbouring field a mixture of these grasses sown in 1946 has regularly yielded the most satisfactory material for ensilage grown on the farm. The value of a timothy-meadow fescue sward for silage-making lies in the late and relatively slow development of the flowering stalks compared with ryegrass in particular and, to a less extent, with cocksfoot. The crop remains at the optimum stage for cutting for quite a long period.

In the light of all our experience, both in seeding down and in utilization, we have gravitated gradually towards the following standard seedings :

For hay or silage	lb. per acre	For pasture	lb. per acre
Timothy S.48 and/or S.51	6	N.Z. certified ryegrass	4
Meadow fescue S.53 and/or S.215	12	Ryegrass S.23	8
Alslke	3	Cocksfoot S.143 and/or S.26	8
S.100 white clover	2	Alslke	3
Total	23	S.100 white clover	1
		N.Z. wild white clover or S.184	1
		Total	25

MARGINAL LAND RECLAMATION AT MIXON HAY

A limited area of land sown with the pasture mixture is reserved for our early cuts of silage. This permits the silage-making season to start earlier than if reliance is placed entirely on the main silage mixture.

After-treatment and Management The treatment and management after sowing, which controls the productive life of the sward, seems to be particularly important in high rainfall districts. The leaching effect of high rainfall on lime and nitrogen is considerable. This leaching can be checked to some extent by heavy trampling with sheep and cattle during dry periods. The practice we have found most successful is to graze the young seeds as soon as a bite is available, preferably with sheep, the more the better, six to eight weeks after sowing. Thereafter it is intermittently grazed hard and bare in a few days when in the full leaf stage followed by rest periods of three to four weeks.

Fertility on upland pastures cannot be established quickly ; it has to be built up gradually. This is best done by consuming the herbage on the land where it is grown and by periodical applications of phosphates and lime. We now make a practice of applying 3 cwt. superphosphate per acre every other season and 30 cwt. ground limestone dust per acre every three years. Occasionally a top dressing of a nitrogen fertilizer is given where the proportions of clover in the sward greatly exceed that of the grass, but we place the greatest reliance on clovers for building up and maintaining the level of fertility, and our management and treatment of pasture is designed primarily to maintain a healthy, vigorous clover sward.

It is exceedingly difficult to control grass entirely by stock. The varying rate of growth throughout the season has to be dealt with, in part, by conservation for winter use. The flush growth comes in late May and June, and every effort must then be made to prevent the grasses running to flower. To carry sufficient stock to do this would mean over-stocking during the rest of the season. The solution lies in silage-making when the flowering shoot is still in the leaf sheath. It is equally important not to cut too soon, as it is to cut not too late : the flowering shoot should have started growth up the leaf sheath to be caught by the mowing machine knife. If it is not cut the flowering shoot which has formed in the base of the plant will shoot up shortly after cutting and before much additional leaf has grown ; whereas, if it is cut off the plant will tiller afresh and produce another full crop of leaf before it sends up new flowering stalks.

Where the grass is cut and carted off for the making of silage or hay the loss must be made good by returning the equivalent manurial value to that which would have been replaced had the crop been consumed *in situ* and returned to the land as dung and urine by the grazing animal. Where it is proposed to take a silage cut we apply a dressing of 2 cwt. nitrogen, 3 cwt. superphosphate, and 1½ cwt. muriate of potash per acre about six weeks before the intended cutting date ; or, when available, 10-15 tons of farmyard manure per acre. We normally take only one silage cut a year and graze for the rest of the season.

Haymaking and Ensilage Haymaking in a normal season is a difficult business under our exposed conditions. The method we have found most successful, and which is now the routine practice, is the tripod system. The hay when about three parts made is put into " pikes " or " cocks " on tripods, each containing 5 to 7 cwt. During good weather, which occurs very occasionally, perhaps one year in three, the tripods are dispensed with and the pikes increased in size up to 15 to 20 cwt. apiece, according to the dryness of the hay at that time. After the hay has

MARGINAL LAND RECLAMATION AT MIXON HAY

matured and sweated out, a process which takes from four to six weeks, it is baled on the field direct from the pike. A stationary baler is set up and operated at a convenient spot, the pikes being drawn to it by means of a rope encircling the base of the pike and pulled by horse or heavily ballasted tractor.

Although the tripod system has been found to be the safest and best method, haymaking in a normal season is a hazardous undertaking. This is due not entirely to the high rainfall, but more particularly because the district is frequently clouded over and the rate of evaporation is very slow. In addition, much work is entailed in replacing the tops of pikes, even after they have been roped down at the time of making. In consequence, and because of the relative insignificant losses resulting from the making of silage as compared with hay, silage-making by the pit method has gradually replaced haymaking as the standard means of conserving grass for winter use. In 1945 we had 170 tons of hay and 20 tons of silage; in 1949, 110 tons of hay and 400 tons of silage.

Livestock

The livestock policy has centred on the rearing of dairy heifers.

An attested herd of 18 Ayrshire and Shorthorn nurse cows has been established, and calves have been bought from breeders of attested Ayrshires, from non-attested farms, or, as a last resort, from the local market. It has proved an uncertain business, owing to the doubtful value of most of the calves bought—an uncertainty which is resolved only after 18 months or 2½ years. The costs are the same, whether the heifer proves a high-grade or a low-grade animal. High altitude is no protection against the ills of calfhood or against hooe in early autumn. Spring- and summer-born calves have to be housed for the first twelve months of their lives. All cattle must be housed from early October to May, except that in open autumn weather mature stock may be able to run out by day till mid-November (even Galloways, tried in the earlier years, cannot be wintered out). Winters are, therefore, inordinately long and fodder consumption prodigious. On the other hand, we have clear evidence that a goodwill in this trade can be built up over a number of years. The average quality of calves we have been able to get has risen appreciably. Tuberculosis is comparatively easy to avoid.

The sale of milk from Mixon Hay is impracticable in winter. At West-brook Head, however, where a modern shippon is situated close to the road, a small milking herd has recently been established. Despite the high altitude, yields have been satisfactory—an average of 760 gallons per heifer.

To some extent sheep can be used to equate grass production and consumption. There are, however, strict limits to the numbers that can be run with safety. We have throughout maintained a pure-bred Clun flock, the number ranging from 80 ewes up to 200. The right number for safety appears to be about 120. Latterly we have wintered the ewes, with advantage, in the lowlands.

Far outweighing all technical problems has been that of labour. At no time have we been able to find a sufficient number of men willing to live on these remote upland farms; we have been compelled to transport more than half the labour required by motor-van from three or four miles away.

Value of Improvement Evaluation of the improvement effected by reseeding is notoriously difficult. Stock-carrying power, as measured by the June Returns, has been increased greatly. Expressed as cow units, the figures are:

1940	1944	1949
87	104	165

MARGINAL LAND RECLAMATION AT MIXON HAY

On the other hand, the tenant right valuers who have been employed each year put the value of improvements effected by reseeding at approximately 25s. per acre only. Low as this figure appears to be in the light of the stock-carrying power of the land, it is instructive as a measure of the assessed profit-earning capacity of a large stretch of improved land at such an altitude, and of the attractiveness of the farm as a commercial venture to a presumptive ingoer.

During our occupation we have thought it sound policy to build up an attested stock and to maintain as many beasts as possible throughout the winter. Such a policy is, however, by no means essential; from a strictly commercial standpoint it would probably be better to use a large area for summer grazing, either by buying stores or by agistment. Alternatively, the farms can be run as summer milk farms with calf rearing in the winter, provided the larger homestead were divided to allow for accommodation of two families.

Clearly the development of the whole area turns on maintenance of an adequate labour force. This does not imply erection of a large number of cottages, but rather improvements in the existing farmhouses.

SOME INFECTIOUS DISEASES OF DAIRY STOCK

J. C. BUXTON, M.R.C.V.S.

School of Agriculture, University of Nottingham

THE word "disease" indicates any departure from health and covers a great range of conditions, from the most trivial local disorders to widespread epidemics. The infectious diseases of cattle, which cause the greatest loss, can be classified under a number of heads depending upon their cause and position in the body, and they can be of a general or local character, according to whether the whole or only a part of the body is involved. The methods employed for the control and eradication of a disease are dependent upon its causation, but predisposing causes play a part which often is no less important than that of the chief or exciting cause. Age, management, and general environmental conditions affect the occurrence of certain diseases.

Although a number of infectious disorders of cattle are caused by filterable viruses and protozoa, the commonest are of bacterial origin, and these again may be local or general, according to whether they affect the whole body or only part of it. Bovine mastitis provides a good example of a serious local disease, whilst anthrax can be cited as an illustration of general systemic disturbance. Disease may also be acute and rapid in onset and duration, or it may be slow and more chronic in its effects.

The general methods for the control of disease in stock vary with the behaviour of the causal agent. In some conditions the main exciting bacterial cause can frequently be removed by suitable medication, whilst in other diseases, the causal agents of which are not affected by any recognized treatment, control is best effected by preventing the spread of disease through the herd, and, in the more acutely infectious conditions,

SOME INFECTIOUS DISEASES OF DAIRY STOCK

from one herd to another. Such prevention of spread can be carried out in different ways. One method consists in testing the members of a herd for the presence of disease and removing affected animals from healthy ones, whilst another lies in the protection of suitable animals against a prevailing condition.

Certain diseases of dairy stock are controlled by legislation and are notifiable under the Diseases of Animals Act and Orders. In general, it is true to say that a disease is guarded by legislation because its occurrence produces serious economic loss, though there may be another or additional reason for control in the case of a disease that is transmissible to man with serious effects. It is evident that foot-and-mouth disease, if unchecked in this country, would rapidly produce economic loss on a serious scale. This is due to the extremely contagious nature of the malady, and to the fact that the complete recovery and return to normal of an affected animal does not usually occur. Anthrax, however, not only produces a rapidly fatal disease of farm animals, but is also directly communicable to man.

Immunity and its Uses in Disease Control

Some knowledge of immunity is necessary in order to appreciate the possibilities and limitations of vaccination and other methods used in the control of disease. The resistance of the host to parasitic invasion constitutes immunity, and this can be of several types. *Natural immunity* is a state characteristic of a particular species or animal, in which complete resistance is shown to a given disease. As examples, poultry do not suffer from anthrax, and swine fever is confined to pigs. A natural immunity can be inherited, but an acquired immunity results often from contact with a disease, when the body of the host sets up a resistance to combat infection; this may be of short or long duration and in some cases may last the whole of the animal's life. In cases in which the protection is of long duration, the term *active immunity* is applied; such conditions are generally associated with a previous attack of the disease. *Passive immunity* is one which is temporary and is provided under natural conditions by the maternal blood or milk. In certain laboratory tests and in the provision of an *artificial immunity*, use is made of these facts to combat disease. An artificial immunity may be either active or passive, and in the former the animal's own tissues play a part in protection. The body of an animal will set up a resistance to invasion with bacteria by producing antibodies to the invading organisms. Such a response on the part of the body takes some time before coming fully into action, but when it does it is extremely effective and frequently affords protection against a particular disease long after the condition no longer exists. The antibodies responsible for this protection are specific to the disease which brought them into being and often can be detected in the blood long after the infection has subsided.

The agent which gives rise to the antibody (in this case the invading bacteria) is known as the antigen, and use is made of the antigen-antibody reaction both for detection of and protection against disease. It is not necessary to use virulent bacteria as antigens for the stimulation of protective antibody production, and so it is usual to employ either dead organisms or those which, although alive, do not retain their power to produce disease. Such organisms may have been attenuated in a number of ways, one of which consists in cultivation outside the animal body and on artificial media for a long time. In some cases an effective antigen can be produced by extracting only that part of the bacterial body which is antigenic. In addition to the use of antigen as a producer of antibodies, it is possible to use it for the detection of antibody in the blood of an animal. Such a test is of great value

SOME INFECTIOUS DISEASES OF DAIRY STOCK.

to show whether or not an animal has suffered, or is suffering, from a specific disease. The agglutination and other similar laboratory tests are merely antigen-antibody reactions carried out for the detection of disease. In the case of the agglutination test, use is made of the fact that under certain conditions antigen and antibody tend to combine and fall as a deposit to the bottom of a test tube.

Whereas active immunity consists in the stimulation of the body to produce its own antibodies, passive immunity is merely the provision of additional antibodies to assist those which the body already possesses.

An appreciation of the mechanism of immunity leads to a clearer conception of disease control in general, and in particular assists the understanding of the different infectious disorders of dairy stock.

Brucellosis or Contagious Abortion Brucellosis, or contagious abortion, is the cause of widespread source of loss in the dairying industry at the present time, but there are no very accurate figures available by which the loss can be measured. The responsible agent is the micro-organism *Brucella abortus*, which is also transmissible to humans and sometimes causes undulant fever. Such disease in man is often milk-borne, but it can occur also as a result of contact with infective material. The losses occasioned by abortion are very extensive, and cows which have aborted may become sterile for a variable period. It is usual for the disease to gain entry into a herd by the importation of an infected cow, and from that time onwards the number of abortions often increases annually and reaches a peak in three to four years. In the great majority of cases, infection takes place by the mouth from the ingestion of food which has become contaminated with organisms from an infected animal. The first manifestation of the disease is usually the sign of approaching labour towards the end of the gestation period but before full term. The foetus is often dead at the time of birth, but if abortion occurs at or near to full term, the calf may be produced alive but in a weak state and soon to die.

The diagnosis of brucella abortion is carried out in the laboratory by means of the agglutination test. In this work, the blood serum of the suspected animal is mixed with the known antigen in rising dilutions. In this way some estimate can be formed of the intensity of the infection in the animal, according to the dilution at which agglutination ceases. This end point is known as the titre of the serum. An attack of brucellosis will provide an animal with an immunity which may last for a long time, during which there will be agglutinating antibodies in the blood.

Probably the best method of combating this disease is to attempt to provide the cattle early in life with a long-lasting immunity, and this is done by vaccination. The vaccines which are at present in use for protection against contagious abortion consist of live, attenuated strains of brucella, which have lost their power to produce disease but which are still capable of eliciting an antibody response and, therefore, of promoting immunity. The vaccine which is in common use at the present time is known as Strain 19. The effect of injecting the vaccine is to stimulate the production of antibodies and so, of course, to produce a positive reaction to the agglutination test. Care must be used in the vaccination of cows against brucella infection, for if the vaccine is used in a pregnant animal, the organisms may find their natural habitat in the gravid uterus and produce abortion.

In veterinary laboratories the diagnosis of abortion is carried out by isolating brucella organisms from the foetal stomach, following which they grow on artificial culture media and can be identified.

SOME INFECTIOUS DISEASES OF DAIRY STOCK

It will be seen that the control of brucella abortion in cattle can be carried out either by the identification of affected animals (by the use of the agglutination test) and their removal from the herd, or by the vaccination of young stock and non-pregnant adults. In addition, the risk of importing infected animals must be avoided, for there is no recognized curative agent available against members of the brucella group of organisms.

Bovine Tuberculosis Like brucella infection, bovine tuberculosis constitutes a serious and ever-present menace to dairy stock. It is probably the most widespread disease of cattle, and it has been suggested that a high percentage of animals in Britain are affected with the condition to a greater or lesser extent. However, tuberculosis is a slow and chronic disease and may take a long time to show itself clinically, but its presence can be detected at an early stage. The causal organism, *Mycobacterium tuberculosis*, may obtain entry into the body by ingestion or by inhalation (the latter being the more common), and thus the lungs or the alimentary tract become the first foci of infection. From here the organisms are carried to the lymph glands which drain the part, and they may be held up for a while in the lymphatic system. In the meantime the primary seat of infection may spread locally and lead to clinical symptoms, such as pleurisy or cough, whilst the organisms invade the blood stream and lead to a generalized infection of the body.

It is possible to detect the disease in its very early stages by the use of tuberculin. This agent consists of the products of growth of the tubercle bacillus, which are largely protein in character and are called tuberculo-protein. The modern tuberculin test consists of a local allergic reaction between the protein of the tuberculin and the similar protein of the tubercle bacilli when present in the body. These two interact to produce the localized swelling of the intradermal reaction. It is important to realize, however, that in this test the intensity of the reaction is not necessarily an indication of the extent of the infection in the body, and whilst on the one side it is possible for a minute focus of infection in one gland to elicit an extensive response, on the other, one may encounter an animal in a clinically advanced stage of the disease, from which it may be difficult to evoke even a positive reaction to the test. The production of modern highly purified tuberculin has made possible the clearance of the disease from very many self-contained herds in the country, and there is no doubt that for a system of testing and segregation, tuberculin is a potent weapon for the control of the disease in dairy cattle. In addition to the disposal of cows which react to the tuberculin test, it is important that the hygiene and management of a self-contained herd should be of a consistently high standard, in order that the general level of health can be maintained at its best.

In the so-called flying herd, in which the population is often changing and fresh cows are being added frequently from unknown sources, the whole problem of the maintenance of the health of the community becomes complex, and it is probable that such herds act as disseminators of disease, and particularly of tuberculosis, on a considerable scale. Under such conditions of management it is often impossible to avoid importing tuberculosis, and when this happens the disease can spread throughout the herd with great ease and rapidity; it is in such herds that cows can often be found giving tuberculous milk, or suffering from clinical disease.

Clinical bovine tuberculosis is scheduled under the Tuberculosis Order of the Diseases of Animals Act, which provides that animals showing signs of advanced disease or giving tuberculous milk must be slaughtered and the owners compensated. This piece of legislation does not go beyond the

SOME INFECTIOUS DISEASES OF DAIRY STOCK

removal of the actively open case, or the cow which constitutes a danger to the milk-consuming public, and it is not intended that it should. The Tuberculosis Order aims at the removal, as often and as early as possible, of clinical cases of tuberculosis. Research into the practicability of vaccination against bovine tuberculosis has been in progress for some years, but it is doubtful if control by vaccination will ever be of practical value in cattle. The Attested Herds Scheme has proved to be of great value in decreasing the number of tuberculous herds in the country, and the proposal to free large areas of infection by this means would provide the best method of eradication.

Johne's Disease Johne's disease is an important and widespread condition of cattle, which, in some respects, resembles tuberculosis.

The organisms enter the body by the mouth, and since they are present in large numbers in the faeces of affected animals, food and water quickly become contaminated. One of the most potent sources of infection is the farm pond, where infected animals stand often for long periods. Pastures may remain infected for a variable time, depending, to some extent, on weather conditions. The symptoms of the disease are slow to appear and take the form of a progressive emaciation, accompanied finally by a persistent enteritis with diarrhoea. The disease often develops very slowly and years may elapse from the time of infection to the onset of symptoms. Frequently some debilitating influence, such as parturition or exposure to unsuitable environmental conditions, has a very marked effect upon the rapidity of the disease, and the animal may waste and die within a short time.

Diagnosis in the early stages, before clinical symptoms have made their appearance, is difficult, and this makes the disease in herds hard to control. In the majority of cases it is not until the cow scours intermittently that Johne's disease is suspected. At this stage the organisms are actively multiplying under the mucous lining of the intestine, at which time they appear in the faeces, sometimes in large numbers. Here they can be demonstrated in the laboratory by suitable methods of preparation and staining, but it happens occasionally that Johne's bacilli cannot be found in the faeces of affected animals, and so, whereas the presence of typical organisms is diagnostic of the disease, a negative finding does not necessarily indicate that it is not present. The direct diagnosis of Johne's disease is likely to remain in this rather unsatisfactory state until a more suitable technique can be devised for demonstrating Johne's bacilli in the body. The general control of Johne's disease is not easy, largely owing to the difficulty of diagnosing the condition in its early stages, and the use of a diagnostic agent similar to tuberculin, although of value in some cases, has been found not to be reliable. Experimental work into the possibilities of vaccination is being carried out, but it is not possible to say at present what the indications will be for procedure in the field.

Mastitis The set of conditions known as "mastitis" is classified as local disease. The term "mastitis" denotes an inflammation of the udder, and this may be due to one of a variety of causes, for although inflammation of the udder may arise from exposure, injury, or environment, the great majority of cases and outbreaks are of bacterial origin. In spite of this, however, in mastitis, as in other conditions, predisposing causes are of great importance and play a part in deciding whether or not an individual udder, or even a quarter, will succumb to infection, and there is ample evidence to show that careless and dirty methods of dairy husbandry can set the stage within the udder for the entrance and vigorous action of organisms. Therefore any steps towards the prevention or eradication of

SOME INFECTIOUS DISEASES OF DAIRY STOCK

disease in a herd are bound to include the consideration of environmental, as well as primary exciting, factors.

Amongst micro-organisms which are most usually associated with outbreaks of bovine mastitis, streptococci are common. Streptococcal mastitis is one of the chief problems with which the dairying industry has to contend, and by far the most prevalent form of this disease is that associated with *Str. agalactiae*. An infection may gain primary entrance into a herd in a number of ways, but it is probable that the commonest is by the purchase of an infected cow; thereafter the disease can spread through the herd with great ease. Following the introduction of a focus of infection, mastitis spreads as a result of the transference of organisms at the time of milking, together with a sufficient amount of tissue damage to ensure that they are provided with a suitable environment for growth and multiplication inside the udder. However, some cows show a remarkable degree of resistance to streptococcal mastitis and will remain free from clinical disease for long periods of time, during which they would seem to have been exposed to no less risk than infected members of the same herd. In many instances it is difficult to explain satisfactorily the reasons for such apparent immunity, and it is probable that, in these rather rare cases, a number of different factors are involved. There is reason to believe that some udders have a greater resistance to tissue damage, but observations on a large number of animals which become reinfected after treatment lead to the supposition that the average cow enjoys little or no lasting immunity to streptococcal mastitis as a result of infection. Staphylococcal mastitis is not so common as that which is caused by streptococci, but it can be a serious disease.

The main diagnosis of bovine mastitis is carried out, in the first instance, by clinical methods, and it is important to appreciate that indurations in the quarter and clots in the milk are signs not only that the disease is present, but also that the organisms have been multiplying in the udder for some time and have had ample opportunities to travel to other cows. It is at this stage that the bacteriological examination of milk samples from the herd can be of value, to detect cows which are in the earlier phases of infection and thus to avoid the possibility of a serious outbreak. In most laboratories where bacteriological examinations of milk samples for mastitis are carried out, the technical methods consist in cultivating the organisms on solid media. With practice it is possible to recognize the various growths of mastitis-producing germs.

The control of streptococcal mastitis, although simple in theory, is more difficult in practice. Streptococcal and staphylococcal infections respond well to treatment with penicillin and other types of preparations, but it must be realized that medication must be adequate in dosage and in frequency in order to free a herd efficiently from the disease. Work on the treatment of streptococcal mastitis with some members of the sulphonamide group of drugs has shown that whilst these preparations are highly active against the organisms, they are rather less bland in the udder than penicillin and may give rise to a certain amount of tissue irritation. Of the types of bovine mastitis other than that due to *Str. agalactiae*, two respond to treatment with penicillin; these are due to *Str. dysgalactiae* and *Str. uberis*. Summer mastitis, caused by *Corynebacterium pyogenes*, and tuberculous mastitis are controlled by different and separate methods.

Co-operation between Vet and Farmer The control of infectious disease in dairy stock is inevitably linked with husbandry and management. To prevent a disease from entering a herd, or to control its effects after it has done so, with a view to its rapid eradication,

SOME INFECTIOUS DISEASES OF DAIRY STOCK

calls for a high degree of co-operation from the veterinarian and the owner.

In general, most of the advances in the control of infectious animal diseases in recent times have resulted from an increased knowledge of the habits and weaknesses of the causal organisms. In many cases it is now possible to control, either by segregation, vaccination, or by a combination of both, a number of diseases of stock which a few years ago were regarded as serious plagues.

TWENTY YEARS OF FARMING IN WEST SOMERSET

R.T. CLARKE

Tivington, Minehead

It is with deep regret that we learn that Mr. R. T. Clarke died suddenly on April 29.
Editor

TO give the reader some idea of the various types of farming in this district, it is necessary to outline the area to which this article refers. Broadly speaking, it contains some first-class land in the Taunton Vale, with other smaller but similar pockets to the westward, bounded on one side by the Bristol Channel and on the other by the Brendon Hills and Exmoor. Thus, although small, the area contains almost every type of agriculture practised in this county, on almost every type of soil, from small areas of clay to larger areas of very light and extremely stony loam; from sea level to well over 1,000 feet.

Most of the farms are on the small side, although there are a number of between 200 and 400 acres that readily lend themselves to the ley system of farming which has become so popular since the war ended. Almost exclusively they are farmed by tenant farmers.

Looking back over the last twenty years, it is amazing to realize the changes that have come about in the methods used to obtain a greater yield from our soil, and yet be forced to come to the conclusion that on the smaller farms the cropping system remains almost unchanged. The introduction in more recent years of the three-year ley to replace the common-place seeds mixture of one year's duration is probably the most important item in the changes in rotations on the larger farms—and the majority of them contained a high proportion of arable-sick land which has benefited enormously from a rest from the plough for a few years, and has, upon being re-broken, given excellent yields of grain. Yet there is still a firmly established place for the one-year ley on the smaller farms, where a bulky hay crop remains a first consideration.

On the smaller farms the old four-course rotation of roots-corn-clover-corn is still followed almost as religiously as it was twenty years ago. The only variation is that economic necessity occasionally leads to the growing of two corn crops in succession after the roots, a practice which is not now frowned upon as it would have been some years ago.

There has been a considerable increase in recent years in the growing of catch crops on land to be cropped with the later-sown roots the following year. Mustard, trefoil and Italian ryegrass undersown in the previous corn crop, and vetches and oats, are the most popular mixtures, grown mainly for the sheep, with the latter mixture sometimes used for arable silage.

TWENTY YEARS OF FARMING IN WEST SOMERSET

Certain small areas devote quite a large acreage to market-garden crops, mainly early peas and savoys, which are sold in the ground to dealers. A small number of farmers also grow a few acres of Aberystwyth strains of grasses for seed, mainly S.48 timothy and S.143 cocksfoot, the crops being drilled at a width of 20 inches, and three or four consecutive seed crops being taken. Broad red clover seed is saved when possible on several farms if the hay aftermath is not required for stock feeding, and a small acreage of certified white clover is also seeded.

Farming to survive the depression of the early 1930s was a pretty grim business in this district as elsewhere, despite the fact that most of us had "something of everything" and could hope to pick up somewhere. Almost every farm then carried its own ewe-breeding flock, and the majority were rearing and fattening Devon cattle, and not milking a dairy. Malting barley was the main cash crop, with wheat secondary, except on the heavier soils which could not produce a good malting sample and consequently mostly grew wheat and beans for sale. In spite of the small amount of milking entailed, a large staff was carried for the acreage—usually about three or four men per 100 acres. In those days many more acres of roots were singled, more fencing was involved, and more corn weeding was done. With a high ratio of arable to pasture, all the larger farms required two or three carters, and these men had to be out ploughing in all weathers to avoid getting behind with the work. With wages around 30s. per week, and rent per acre about the same, it was a hard row to hoe, for most of us were under-capitalized and could not find the cash to buy one of the "new-fangled tractors" then just coming on to the market in larger numbers. In 1930 a great many farms were run by men who could capitalize only to the extent of about £10 per acre, and I well remember buying my first tractor in 1935 for £135—an outlay which had to be recouped by doing contract work on neighbouring farms.

At the uncontrolled fat stock markets in those days well-finished Devon cattle were making less than £20 apiece, and fat sheep prices were comparatively worse; Malting barley of good quality commanded 30-35s. per quarter, with wheat standing at a lower figure. The yields of barley were lower than those today, but the quality, especially in the Porlock district, was extremely high, several World Championships being won at the Brewers' Exhibition with samples from a few of those farms on the lightest and stoniest soil nearest the sea mists of the Bristol Channel. The varieties grown were invariably Plumage-Archer, preferably Dr. Beavan's 1924 strain, and Spratt-Archer, but today quite a large acreage of Abed-Kenia is grown, some of it being of surprisingly good quality, considering the high yields obtained.

Corn from Worn-out Pastures The variety of wheat still favoured is Victor, although a lot of Holdfast was grown during the war years on newly ploughed-up grassland; this stiffer-strawed variety is still preferred on the strongest land, where Victor is liable to lodge. Much more spring wheat is also being grown now that we have the improved varieties of Atle and Fylgia, and these appear to be yielding as well as the winter wheats on some farms.

The war years undoubtedly taught us a greater respect for our father's ideas of husbandry the potential of our soil in grassland when we had perforce to cash those reserves in the national interest. Farmers were amazed at the very high corn yields obtained from worn-out pastures which the older generation of farmers alleged it was sacrilege to break up. In common with other districts, we had the experience of third successive corn crops

TWENTY YEARS OF FARMING IN WEST SOMERSET

becoming laid, with all its attendant difficulties of harvesting, and about which incidentally our men and the Land Army girls then on the farms were so magnificently uncomplaining. We also had the blight of extremely virile crops of charlock appearing on a lot of this land which in many cases had lain unploughed for sixty years. It was indeed an opportune time to introduce the wider use of, first, sulphuric acid contract spraying, and later selective weed-killer to cope with this persistent weed. The awareness of the fertility locked up in this old grassland led to a much wider use of the three-year ley on all the larger farms, and crops very much above the average were obtained from the old arable land after it had been rested and fed for a few years. With a fairly high rainfall to assist early establishment, some really good young leys were appearing by 1941, full of wild white clover and the more productive S.100 white clover. It was then obvious that this comparatively new type of arable farming had come to stay, and that we were at last becoming more "grass conscious".

The district has always been self-supporting in oats, with Star now the most popular variety. Some of the hill farmers prefer the Black Supreme, since they find that this variety does not shed so much at harvest-time with them.

Sugar beet is a comparatively new crop to us, very little being grown before the war. On certain selected land, when the crop is done well, yields are very high ; 16-18 tons per acre of washed beet are frequently obtained. But very little outside labour is available, so that only small acreages are grown—and these on the better class farms, where a high opinion is held of the feeding value of both tops and pulp.

The general farm usually grows maincrop potatoes, Majestic being the most popular variety, while certain farms with sufficient labour to deal with the crop grow several acres of earlies, usually Arran Pilot.

Almost every farm in West Somerset has its own orchard, from which in most cases a good crop is regarded as Heaven-sent ! They have certainly received little encouragement from the farmer—it is either an apple year, or it is not, and that's that ! The Output per acre Recording Scheme which is being run in the county this year has certainly shown those participating that it is high time more attention was given to these farm orchards. Incidentally this is an excellent scheme and one to be strongly recommended as a sure means of finding out the weak spots in a farm's output and so lead to a remedy and ultimately increased efficiency and production.

The larger West Somerset farms go in for mechanized silage-making and grass drying, but the majority still cling to haymaking, which the now general use of the tractor sweep has speeded up considerably. Even so, many farmers are becoming silage-minded and will no doubt be trying out the pit method in greater numbers after the next bad haymaking season. During the early 1930s almost the whole of the hay crop in these parts was pitched by hand, only a small number of hay-loaders being in use ; the bulk of it had to be carted again for feeding during the winter. The use of the hay-sweep so greatly reduced the time taken to clear a crop that it might almost be said to have revolutionized haymaking ; it has certainly put to some other use a motley collection of old motor-cars where a tractor was not available !

A large number of the valley farms have an "off" holding up in the hills, but where they have not, keep is regularly taken at grass-letting sales for summering the stock, as most of the available pasture on the home farm is let up for mowing by early May. This usually meant that the number of cattle carried on the holding was dependent upon the number that could be fed and housed during the winter, using mainly home-produced foods.

TWENTY YEARS OF FARMING IN WEST SOMERSET

Milk and Beef There has been a marked increase in milk production in recent years, and this has entailed a larger acreage of marrowstem kale and cattle cabbage being grown for the dairy stock in place of the turnips and swedes formerly grown for sheep. Swede-grinding is now uneconomic, and this crop is usually drilled mixed with thousandhead kale, both for wintering the lambs, which are folded ahead of the in-lamb ewes, and for later use by the couples. Every farm grows its requirements of mangolds, which is still regarded as an indispensable crop, for cattle and ewes and lambs alike.

During the war, when milk was a top priority, many farmers turned over to milk production, and these men have improved their dairy herds and standards of clean production considerably, the majority now being attested, or aiming at becoming so. All the main dairy breeds are kept, but Shorthorns are the most common, and several of these herds are now grading-up to pedigree status.

The quality of the Devon cattle kept in the district is very high, and although one or two other beef breeds have been tried locally, they have never seriously rivalled the "Red Rubies". The great advantage of this breed is that they put to excellent use large quantities of roughage. Around two years old they will do quite well on straw and mangolds with a little hay throughout the winter in yards, being finished in early summer at top price on leys and on the productive marshes that run the length of the coast. Instead of the 8-10 cwt. cattle required for the 1930 market, these cattle are now kept on to nearer three years old and finished at weights of 12-14 cwt. Large spring and autumn sales are held in the hill districts, and are attended by buyers from all over the country. The number of calves reared per cow has increased almost threefold since 1930, when the majority of Devon cows reared only their own calves ; it is now becoming very difficult to supply the demand in the district for good rearing calves. The introduction of the calf subsidy has also encouraged these beef rearers to carry on instead of turning to milk as a more profitable business.

Sheep and Pigs Sheep occupy a most important place in West Somerset farming, and large numbers are still kept. They are an essential factor in keeping up the fertility of our lighter arable land, which comprises the greater part of the district. Even the small dairy farms which have dispensed with a breeding flock usually grow a few acres of roots on which to fold and fatten store lambs bought in from the hill markets in the autumn. A few ram-breeding flocks of registered Dorset and Hampshire Downs are kept, but most of the better class flocks are now almost pure Dorset Downs after several top crosses of a ram of this breed on Devon Closewool or Exmoor Horn ewes. Working up the flocks in this manner has hardened the constitution of the ewes—a necessity in the semi-hill areas at around 800 feet where the largest flocks are kept.

A few Dorset Horn flocks are kept on the better class lower lands, and this breed is becoming more popular now because of the much heavier weights obtained. Rams of this breed are also used for crossing with Exmoor Horn ewes on some farms. The majority of hill farmers keep a registered flock of Exmoor Horn ewes, crossing part of them with a Down ram to give a higher priced lamb at the autumn sales, and retaining the pure ewe lambs to replenish and add to the flock. To qualify for the full benefits under the Hill Farming Act, it is essential to keep this, or some other mountain breed, in its pure state. As with the cattle, the aim of the sheep fattener is now a much heavier animal—around 70 lb. dead weight, compared with the fashionable 40 lb. of 1930.

TWENTY YEARS OF FARMING IN WEST SOMERSET

There is generally no large-scale pig-keeping, although a few farms with Danish-type piggeries breed and finish off their own bacon pigs ; but most farms carry two or three Saddleback sows, which are crossed with a Large White Boar, the weaners being sold. Poultry-keeping on the general farm is increasing, with battery cages becoming popular ; and here again most farms carry a small flock as a sideline, with a few specializing and carrying much larger numbers.

Mechanization Little has yet been said of the machinery used, which varies widely in such a mixed farming district. Almost every farm now has its own tractor, although a number of cart horses are still kept for the lighter work such as hauling, drilling and harrowing in, grass cutting, etc.

The most popular implements for obtaining a fine tilth prior to seeding are the spring-toothed harrow, disc harrow, and roller and drags.

Combine harvesters are coming into wider use on the larger holdings, but few users of these machines have their own corn driers. The small number of grass driers used are confined to the larger dairying district to the east of our area. Broadly speaking, where the corn grown annually does not exceed around 80 acres, the crop is still cut with a binder, and after being stacked for about six weeks, threshing is carried out by local contractors.

A machine used more in this district than elsewhere is the combined reed-comber and thresher. Practically all the hay and corn ricks are thatched with the high quality product which this machine turns out, and there is still quite a big demand for reed for house-thatching. The standard of workmanship in both instances is extremely high.

On practically all the larger farms a riding horse is kept as an essential means of getting round the farm ; and not unnaturally this animal is usually of the hunter class so that the owner can have a bit of hunting.

Improved Uplands The example of breaking what has been called "bad, old grass" on the lower-lying farms led in its turn to a lot of steep, marginal grassland being ploughed one way and resown direct, to give more and better grass for the still large numbers of livestock kept on the holdings, despite a much bigger acreage of corn being grown. From the national viewpoint in 1939, the emphasis was on cereal production, and wherever a binder could be used on newly ploughed pasture the field was cropped to corn—even at quite uneconomic levels in the hill country. After a year or two of bad corn failures on this latter land, it was realized that we had to "hurry slowly" up there to get the best results, so a first crop of roots was advocated followed by corn or resowing. Until this was done the primary cause of corn failures was lack of consolidation and wire-worm attack. But when it was appreciated that the old turf took at least two years to rot down after being ploughed in, then this land was not ploughed again after the root crop but only cultivated at sufficient depth to enable the corn to be drilled ; after that it was kept rolled down as tightly as conditions would permit. The wireworms, infestations of which were extremely heavy in some fields, thus had to stay below and exist on the old turf instead of coming up to feed on the roots of the young corn. Provided the trouble was seen in good time, three or four rollings usually controlled this pest. Curiously enough, the other main pest following ploughed-up grassland, the leatherjacket, from which the corn crop often suffered following a one-year ley, did not increase unduly. If damage to the young corn was found to be due to this grub, a dressing of 1 lb. Paris green mixed with 30 lb. bran, per acre, would usually kill it off in sufficient numbers to save the crop.

TWENTY YEARS OF FARMING IN WEST SOMERSET

It was broadcast in a damp state just before dusk, as the leatherjacket moves around on the soil surface at night.

There has been a marked increase in livestock production from the hill farms of West Somerset during the past few years, accomplished mainly through reseeding and the much greater use of fertilizers. This land was found to be very lime-deficient in 1939, and there is no doubt that a lot of phosphate sown prior to correcting this deficiency was partially wasted. Usual dressings per acre on ploughed-up grassland are now 2-3 tons lime and 15-20 cwt. slag. Almost all the more accessible land has now been reseeded, and some wonderful pastures are to be seen, even at 1200 feet. Up here, it is a common practice to sow 1 lb. of rape mixed with the grass seeds; this seems to put a bloom on the lambs before they are sold in the late summer. A few pieces of new land have been enclosed from the hill proper by some enterprising farmers, using a "prairie-buster" plough for the initial breaking of the tough heather and bracken.

The bulk of this land on Exmoor, also a part of the Brendons, qualifies for both hill cattle and sheep subsidy and is eligible for the grants made under the Hill Farming Act, 1946. These grants have had a noticeably recuperative effect on the upland farms, which had been through some lean times previously, and goes to prove that, given the incentive, the hill farmers born and bred to Exmoor can increase their production considerably.

During the past year or two rushes have become a problem on reseeded land although it is perfectly dry and free-draining and, prior to being ploughed, showed no sign of this weed. It was not realized that the rush seed can remain viable for at least sixty years, and that these hills carried more rushes a hundred years ago than they do today. A great deal of reclamation was at that time carried out on Exmoor and persisted for the next thirty years. With the depression the rushes came again. Trials are at present being carried out to eradicate these rushes, and the A.E.C. is hopeful of finding successful means to combat them. Mowing at the beginning and the end of July has been found to weaken a bad infestation considerably, and bruising and heavy application of lime and slag followed by spraying has also been tried out on parts which were not easily ploughable. On the less affected youngest pastures very heavy stocking in the early stages of growth is thought to be the best solution.

Sometimes I have a strong feeling that in our efforts to achieve greater production from our hill farms we are re-learning what our forefathers knew and applied many years ago. It is to be hoped that now the emphasis is on meat production those marginal men who turned to milk in desperation some few years ago will return to the raising of store cattle, which is what their farms are ideally suited to, and a job which they prefer anyway.

An endeavour has been made to give the reader a general picture of West Somerset farming, as from one commercial farmer to another and if variety is the spice of life I think it will be agreed that those who work on the land in this small part of our country are indeed fortunate in this respect. In fact it may well be that this is why there is such a large waiting list for farms in our district, and also why so many young people today are keen to become pupils on local farms to learn the most satisfying, if exacting, of all professions.

The cover photograph shows the kind of country against the background of which Mr. Clarke's article is set.

MEAT AND MILK FROM A YORKSHIRE MOORLAND FARM

T. C. CREYKE, N.D.A., N.D.D.
County Agricultural Officer, Yorkshire N.R.

THE production of first-class Swaledale sheep, good northern Dairy Shorthorn cattle, and a high level of milk production, is the aim of Mr. T. W. Guy on his hill farm at Gilmonby, near Bowes, in the North Riding of Yorkshire. Mr. Guy is fortunate by comparison with many hill farmers in having a very well equipped homestead close to a hard road and standing above, and not very far away from, the village of Bowes. He is also fortunate in having some useful land for a hill farm, but his results are not the product of good fortune alone. Mr. Guy tends both his land and his stock with infinite care and believes in doing both well. He is convinced that this policy pays him best, and he should know since he has been a tenant farmer on this holding for over twenty-five years, and his present practice is based on long experience skilfully blended with new ideas and modern techniques.

Sheep, cattle and milk are the only sale products. Numbers and gallonages give a measure of the amount of production from the farm, but only inspection can give an adequate impression of the quality and health of both the sheep and cattle. Mr. Guy has won many prizes in the show ring, but what is more impressive than the successes of a few individual animals is the uniformly high standard throughout the flock and herd. After walking round the farm—and with a knowledge of the production from other hill farms in mind—one is left wondering what is the explanation of this high level production. The following account of some of Mr. Guy's methods may throw a little light on this query.

The farm consists of 180 acres of in-bye land and some 1,350 acres of moor. The in-bye land, which is now all highly productive grass, even by lowland standards, ranges from 900 feet around the homestead, rising fairly steeply to 1,150 feet above sea level, where it joins the moor. The moorland consists of about 850 acres of open moor which is almost entirely heather, and some 500 acres of enclosed moor, divided into nine allotments. These allotments are situated between the in-bye land and the open moor; the herbage is mainly heather, but there is a greater proportion of heath grasses and some moss. Mr. Guy describes the allotments as ideal hill sheep grazings. The allotments and the open moor range in altitude from 1,150 to 1,350 feet above sea level and are very exposed.

This 180 acres of in-bye land and 1,350 acres of moor carries a regular flock of 600 pedigree Swaledale ewes, plus their lambs in the summer months, and about 180 ewe hoggs for replacements each year, as well as some 40 high-yielding dairy cows with upwards of 60 followers of all ages.

Before dividing the farming into departments for the purpose of more critical examination, it should be emphasized that this is essentially a successful commercial farm and that in practice there is no departmentalization. The whole is run as one unit, the relative claims and awards arising from the conflicting interests of land management, sheep, cattle rearing and milk production, all being skilfully decided by Mr. Guy himself in the light of his long experience.



Swaledale ewes down on allotments for lambing.



Pedigree Swaledale ram bought for £140—a record price for the breed.

THE CONTROL OF WHIPTAIL IN BROCCOLI



Broccoli

(Photo: Long Island Research Station)

Spreading Whiptail. Stunted growing point



Upright Whiptail. Suppression of leaf growth giving bare midribs

I AND CAULIFLOWER (See pp. 130-34)

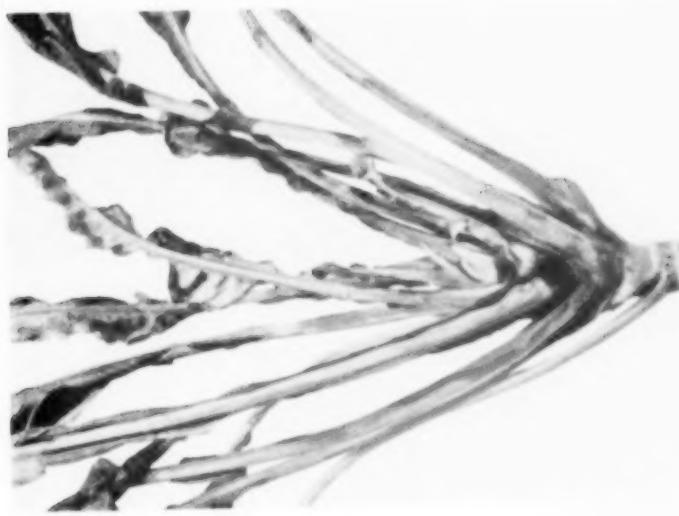


Photo by A. A. Wenzel
Whiptail. Whiplike growing point.
Irregular and wavy leaf.

Cauliflower.



Branched Whiptail. Adventitious buds
arising below ground.



General view of the buildings on the allotment showing dipping pens. The long, low-roofed building is the hogg house with hay shed behind. Left, is the shepherd's shelter, with two cattle boxes and pens behind.



Three typical cows bred by Mr. T. W. Guy

MEAT AND MILK FROM A YORKSHIRE MOORLAND FARM

Land Management The 180 acres of in-bye land are all grass. Bearing in mind the elevation of the farm—950 to 1,150 feet above sea level—it would be unreasonable to expect very early and very late grazing but, with this reservation, both as pasture and meadow its production must compare very favourably with good lowland grass.

About 80 acres of the most accessible and more level land is mown for hay every year. This is all old turf, and although Mr. Guy is a firm believer in direct reseeding and young grass for his pastures, he is satisfied that it would not be of any advantage on these very good meadows. The whole of the meadow land is limed once in five years, heavily mucked in two out of each three years, and gets a dressing of phosphate—usually North African—in the year it does not get manure. From the 80 acres Mr. Guy expects to get from 130 to 150 tons of hay each year. He attaches the greatest importance to quality, and to this end the crop is cut in an early stage of growth. This does not necessarily mean early in the year, as on some of the meadows the shearling ewes and their lambs are grazing until well into May. In normal years the bulk of the hay is piked, so that it is more or less safe from the uncertain weather at the earliest possible stage, and it is then carted on hay bogies in the Scottish fashion to where it is wanted for the winter. All aftermaths are grazed by cattle, but the meadow land is virtually free from stock during the winter.

The remaining 100 acres of grassland is devoted to summer grazing, and it is here that Mr. Guy derives such benefit from direct reseeding and maintaining young swards. He started eight or nine years ago and has reseeded one field each year. He now has about 80 acres of resown swards and is in no doubt about their increased output and the opportunity they offer him for adjusting the season of maximum productivity to suit his policy and needs. The general practice with this reseeding is to plough about a foot deep in the autumn, using a large single-furrow plough of the prairie-buster type which will completely invert the furrow. There is a great deal of stone in the land and after ploughing an 8 to 10 acre field there is usually 40 to 50 lorry loads of stone to remove. The ploughed land lies through the winter, and as early as possible in the spring it is given a preliminary discing and any more stones that are turned up are removed. As the primary purpose of the sward in its first year is to provide keep for the fattening of the year's wether lamb crop, the date of seeding is rather later than is general for the district. The land is usually seeded towards the end of May or early June after liming and appropriate dressing with phosphate. The seeds mixture used is a modified Cockle Park type, including ryegrass, cocksfoot and timothy, with the addition of 1½ lb. of rape. The sward is then allowed to develop until towards the end of August, by which time it is rather ranker than is desirable in the best interests of grassland management, but there is an abundance of exceptionally good food for the 250 or so lambs that are brought down. Since Mr. Guy has adopted this practice of reseeding one field each year, he has been able to grade practically the whole of his wether lambs by about the end of October or very early in November. Previously he used to sell the bulk as stores.

In its second and subsequent years the resown land is grazed mainly by cattle. The whole of the grazing land is limed as required, and, about once in six years, is dunged and in another year is given a good dressing of slag or North African phosphate. Mr. Guy has no doubt at all about the increased carrying capacity of his resown swards as compared with the permanent grass which they have replaced, nor about the economics of this policy, although the reseeding costs him fully £20 per acre. Every field that has been resown has done exceedingly well, and the altitude does

MEAT AND MILK FROM A YORKSHIRE MOORLAND FARM

not appear to make very much difference to their productivity. Owing to the high altitude, cattle have to sleep in early in the year, and the grazing land is virtually free from stock during the winter.

On the open moor and allotments the main activity is in keeping the land well gripped to ensure satisfactory drainage, and Mr. Guy attaches great importance to keeping the heather down by burning in rotation as nearly as possible once in seven to eight years. The burning is normally done during March.

Pedigree Swaledales

Mr. Guy was a founder member of the Swaledale Sheep Breeders' Association, and he is naturally enthusiastic, therefore, about the merits of this breed. He maintains a flock of 600 pedigree Swaledale ewes, all extremely well grown and uniform. In no small degree the present high standard of his ewe flock is due to the great importance he has always attached to the quality of the tupps which he uses. Mr. Guy has always taken a great deal of trouble and spared no expense in the selection of his tupps. This last year he has given full play to his enthusiasm in this direction and paid £540 for one of the tupps which he is using—a record for the Swaledale breed.

In the normal course of his flock management the tupps are put with the ewes round about mid-November. Tutting takes place on the allotments, and the flock is divided into nine or ten units, shearlings being kept separate from the rest of the flock and the remainder carefully selected into groups to match the tup that is to run with them. The ewes are not flushed in any way at tupping time, as is common with the lowland flocks for, since the moor is not capable of supporting a ewe and two lambs, Mr. Guy is not anxious to have twin lambs. Any twins have to remain on the allotments and the higher pastures and therefore compete with the cattle for food. When the tupping is completed the ewe flock is turned out on to the moor, and three or four tupps run with them up to the first week in January. The ewe flock gets no supplementary feeding on the moor until, depending on the season, about the middle of February, but at this period Mr. Guy is most emphatic that it pays him to give them as much good quality hay as they will eat, even though to do so means buying it. Mr. Guy maintains that the lambs are made in winter and not in summer, and that this hay which he feeds between, say, mid-February and mid-April, has a marked influence on the size of lamb and the amount of milk the ewe will have after lambing. He is also convinced that because of their fitness the ewes are very much better mothers and that shepherding at lambing time is reduced.

Lambing begins about the middle of April, and at this stage the shearling ewes are drawn out from the rest of the flock and put on to the pick of the high land grazing for three weeks to a month. The remainder of the ewe flock lamb on the allotments. When lambing is completed the whole flock is turned back on to the moor and, apart from gathering for dipping and shearing, remains there for the rest of the year.

Mr. Guy has taken advantage of the Hill Farming Act to improve his facilities for penning and dipping and has also built a very good hogg house for wintering his ewe hoggs. The flock is gathered for dipping rather more frequently than is usual; dipping normally takes place in April, late June, late August and October. In Mr. Guy's opinion, and bearing in mind his good facilities, the extra dipping is more than justified by the reduced amount of shepherding required. Shearing takes place towards the end of June, and the lambs are weaned at the end of August or early September. At weaning time the lambs are sorted over; those to be retained for breeding go back on the allotments, and those to be graded go straight down on to the

MEAT AND MILK FROM A YORKSHIRE MOORLAND FARM

reseeded land. The gimmer lambs which are to be retained for replacements for the ewe flock stay on the allotments until about Christmas, then they are brought in to the hogg house and kept inside for one or two periods of two days at a time and for occasional nights until they have become "hay bitten"—that is, accustomed to taking hay from the racks. It should be noted that Mr. Guy winters all his own ewe hoggs at home. He believes he can do them better, and now that prices for wintering away are so high, he prefers to buy hay as required rather than endeavour to get wintering for them elsewhere.

The care which Mr. Guy takes in the management of his hill sheep is adequately rewarded in the result. Taken over a period of years he is able to average one lamb per ewe. Each year he has about 160 first-class pedigree draft ewes for sale, which are in great demand by lowland farmers for crossing, and 70 to 80 gimmer lambs as well as something like 250 fat lambs. In addition, he breeds about 20 pedigree ram lambs for sale as shearlings each year.

Shorthorn Dairy Herd Mr. Guy has always been a breeder of shorthorn cattle, and when the Northern Dairy Shorthorn Breeders' Society started a herd book some five years ago he became a member. Now the whole of his cattle are registered. He maintains approximately 40 cows in milk, with 60 female followers of all ages. All the bull calves are sold at a week old, many of them to be reared as bulls for service, the remainder for feeding, and Mr. Guy has a long waiting list of regular customers. This is not surprising, bearing in mind the altitude, when it is known that Mr. Guy has a herd average of very close on 1,000 gallons per cow and a heifer average of over 700 gallons.

Mr. Guy has no arable land on his farm. His summer milk production is mainly dependent on his reseeded swards, and the basis of his winter milk production is the good quality hay he is able to make from his meadow land. The high yields which he is able to maintain bring him the maximum benefit from the animal feedingstuffs rationing scheme, the amount of milk which he sells earns all the coupons he needs and Mr. Guy has no difficulty in providing sufficient food for this large head of stock. He has to provide for a very long winter, as partly on account of the altitude and partly due to the fact that the shearling ewes and their lambs have had the first pick of some of his grazing, the cattle cannot normally be turned out until about May 18 to 22, and they have to sleep in again around mid-October. All pastures are grazed on the "on-and-off" system. In addition to his milk sales, Mr. Guy's herd has been attested for the last five years, and he sells between 15 and 20 attested dairy cattle every year, either as newly calved heifers or as second- or third-calf cows. As with his tupps, Mr. Guy attaches great importance to the bull he uses and spares neither trouble nor expense in their selection.

From this account it will be seen that each year Mr. Guy has for sale about 160 pedigree draft ewes, 70 to 80 ewe lambs for breeding, some 250 fat lambs and 20 pedigree shearling rams; in addition, T.T. milk from 40 high-yielding dairy cows and 15 to 20 attested adult females with a variable number of bull calves for breeding or feeding. All this from 180 acres of high land grass and 1,350 acres of moorland.

ADAPTING HOME-MADE DUSTING MACHINES FOR USE ON TRACTORS FITTED WITH HYDRAULIC LIFTS

L. J. CHURCHILL

National Agricultural Advisory Service, Devon

THE dusting machines described in previous articles in this JOURNAL* can be mounted cheaply and easily on the hydraulic lifts of the Bristol, David Brown, Ferguson, Fordson, and Nuffield tractors, to give rigid control on sloping ground, and to save time when turning at headlands. A six-foot experimental model (tried out on the farm of Col. J. E. Palmer, at Torrington, Devon) and an eight-foot heavier pattern at Mr. Tucker's farm at Putsborough, Devon, have worked successfully at speeds up to 6 m.p.h. Thanks are due to these gentlemen for their co-operation.

For the cage type of machine, the adaptation consists of a length of angle steel about 3 inches longer than the cage (and for a six-foot model, not less than 2 inches \times $\frac{1}{2}$ inch in section) with a length of mild steel bar 1 foot 8 inches \times 2 feet \times $\frac{1}{4}$ inch (drilled to accommodate the dust-container spindles) welded on at each end to form side arms for the container (see A.A. in diagram). Two lengths of mild steel bar, 2 inches \times $\frac{1}{2}$ inch are bent at right angles a few inches from one end, as shown at B.B., and have two pins welded on to engage in the sockets of the tractor's lower link arms as at D.D. These bent bars are welded to the angle steel in the positions shown at E.E. The pins D.D. are drilled to take the standard linch pin.

As some of the dimensions vary slightly for the different makes of tractors, the following figures are given as a guide. Variations of small fractions of an inch can be allowed when making up the framework.

TRACTOR	BRISTOL 20	DAVID BROWN	FERGUSON	FORDSON	NUFFIELD
Diameter of pins (all $2\frac{1}{2}$ inches long) D.D.	$\frac{1}{2}$ in.	$\frac{1}{2}$ in.	$\frac{1}{2}$ in.	$1\frac{1}{2}$ in.	$1\frac{1}{2}$ in.
Distance between joints at E.E.	2 ft. 3 in.	2 ft. 5 in.	2 ft. 6 in.	2 ft. 9 in.	2 ft. 9 in.
Total length of bent arms	1 ft. 11 in.	2 ft. 2 in.	2 ft. 4 in.	2 ft. 1 in.	2 ft. 3 in.
Length of bend B.B.	4 in.	5 in.	6 in.	6 in.	7 in.

The cross-section sizes given for the angle steel and flat bar are common stock sizes and are suggested as the minimum, but they can be varied slightly without altering the layout, and in the case of models up to 10 feet long for the larger tractors, the sizes should be increased accordingly up to half as

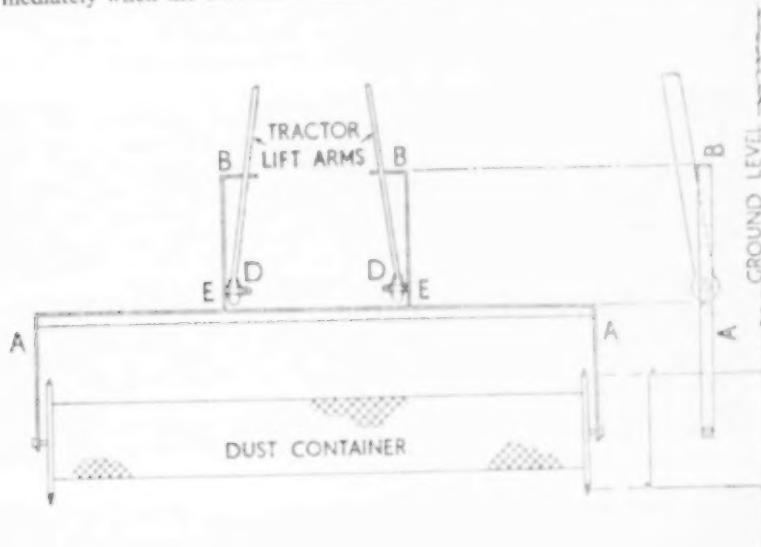
* STANILAND, L. N. and MAYOR, J. A Home-made Dusting Machine. *Agriculture*, 1948, 54, 518-24 and A Small Type of Home-made Dusting Machine for Ridge and Rowcrop Work, *Agriculture*, 1949, 56, 34-8.

DUSTING MACHINES FOR TRACTORS WITH HYDRAULIC LIFTS

much again. It is best to use angle steel for the main frame, since it gives greater rigidity than a flat bar in this position. With large models over 8 feet long, it may be necessary to introduce some form of cross-bracing at the centre of the long bars supporting the wire netting of the container; one way of doing this is to insert an extra square wheel at this point, dividing the container into halves, and using two short hessian bags in place of one long one.

The ridge and rowcrop models can be adapted on the same principle. The same angle-steel frame (or a similar one without the side arms for the container) is securely bolted across the front of the framework (if this is of wood, the use of strengthening corner brackets is suggested in addition), the long skid sides are cut short behind the bag containers, as the lift attachment gives sufficient rigidity. With the tractor-attached dusters, the "bump" of the square wheel is accentuated, and the wooden parts of the implement should be stoutly constructed with a large metal washer under each nut.

The Attachment in Action In the working position the frame is attached to the tractor lift links so that the forward projecting bent arms B.B., lie *under* the links. The tractor can be backed up to the dusting machine and attached in a few seconds, in the usual manner of hydraulic implements, but using only the two lower links. There is no top link attachment. With the hydraulic lift lowered until the links are about 9 inches from the ground, the dusting machine framework will be approximately horizontal when working, and in this position the bent arms should not strike against the underside of the tractor links; should they do so occasionally on uneven ground, no inconvenience or damage will be caused, and a further slight lowering of the lift arms will overcome any tendency to strike continually. The whole assembly works with a "see-saw" action, pivoting in the ball-and-socket joints of the hydraulic lift arms. When the lift is applied the dust container drops slightly but is checked almost immediately when the bent arms touch the underside of the tractor lift links:



DUSTING MACHINES FOR TRACTORS WITH HYDRAULIC LIFTS

it can be lifted, and transported at any convenient height in this position. When transporting the larger containers through gates, the tractor can usually be backed a few feet to manoeuvre the container at an angle, or in some cases it may be possible to run the tractor over stones or timber placed in the gateway and so carry the dusting machine over the top of the posts.

Speed of Travel One model has been tried out at speeds up to 8 m.p.h., but the framework would have to be very strongly constructed to work continuously at this speed; the best economical speed is between 4 and 6 m.p.h. In a trial run of 30 minutes at 5 m.p.h., with an 8-foot duster, approximately 1½ cwt. of dust was applied over 2 acres, this time including a few minutes spent in refilling two bags with dust.

On hilly land the best results are obtained by working straight up and down a slope; bags of dusting powder can then be laid loose in the container, and it is not necessary to tie them to the ends of the frame.

The dusting machines described in the earlier articles were pulled by hand. The containers are four-sided oblong cages of metal rods covered with wire netting in which hessian bags of dust are placed. At each end of the cage is a square wooden wheel with a central spindle, to which a rope hitch is attached. The bumping action of the square wheels shakes the bags inside the cage so that a fine dust is discharged through the material, within a few inches of the ground. The implement is used for dusting kale, etc., and for dealing with infestations in grassland.

The rowcrop model is a variation of the cage type and is capable of dusting crops up to 9 inches high.

THE CONTROL OF WHIPTAIL IN BROCCOLI AND CAULIFLOWER

WILLIAM PLANT, B.Sc.(Hort.), Ph.D., N.D.H.

Long Ashton Research Station, Long Ashton, Bristol

THE appearance of "whiptail" in broccoli and cauliflower has been attributed to molybdenum deficiency⁽¹⁾, and confirmation has been made in this country in the field^(2,3) and also in sand culture⁽⁴⁾. The first report of this trouble in England was made in 1936⁽⁵⁾, and since that time the incidence of the deficiency has undoubtedly increased, due mainly to an expanding cauliflower and broccoli acreage. Many of the new sites and fields used for these crops consisted of broken-up acid pastures which, unless limed adequately, were likely to produce whiptail plants.

In the Gulval area of Cornwall, where excellent crops of broccoli have been grown intensively over many years, the pH values of the soils are high (*pH*, 7.0–8.0), and, whilst Club Root is held in check under this condition, it provides soil conditions in which molybdenum is readily available.

Broccoli and cauliflowers are subject to the toxic effect of excess manganese, and as acid soils frequently contain available manganese in amounts far greater than is required for optimum growth, whiptail can be complicated by symptoms of manganese toxicity.

Visual Symptoms Whiptail is characterized by general stunting of growth, failure to curd, or the formation of unmarketable heads, and in cases where the deficiency is progressive, the plant ultimately succumbs

CONTROL OF WHIPTAIL IN BROCCOLI AND CAULIFLOWER

to secondary infections and dies. The habit of the plant may be upright, branched or rosette; the leaf blade is reduced in size and is irregular in outline, being wavy and sometimes puckered; petioles and midribs tend to be longer than usual; and the growing point may be stub-like or completely blind. Below soil level, adventitious buds are frequently found developing just above the fibrous roots. Leaf colour is not generally affected, but in some cases the plants are strikingly blue-green. Many of these points are brought out in the illustrations.

The symptoms in a mild form may appear in the seedbed, or they may develop after the crop has been planted out. In wet seasons recovery is more likely than in a dry summer when the tendency is for the deficiency to become progressively worse. Under field conditions whiptail can be complicated—excluding other nutrient problems—by Club Root or Broccoli Mosaic.

Incidence of the Deficiency Whiptail has been found on a wide range of acid soils derived from different geological formations. Cases have been reported from the following counties in England: Cornwall (Devonian, granite), Derbyshire (magnesian limestone), Kent (brickearth), Leicestershire (Keuper marl), East Sussex (Tunbridge Wells sand), Wiltshire (Lower greensand); and in Wales, Brecon (old red sandstone), Caernarvon (glacial drift), Glamorgan (old red sandstone drift) and Pembroke (glacial drift).

It appears that, provided the soil is acid, the parent material of the soil has little effect on the problem. However, it does not follow that all acid soils will show whiptail. This is far from being the case, and to quote a Cornish saying, "Where it is, there it is." Whiptail has been recorded on soils with pH values varying from 4.5–6.5.

No broccoli or cauliflower variety has been singled out as non-susceptible to molybdenum deficiency, and all the following varieties have shown typical symptoms:

Cauliflower: Majestic, Novo, Veitch's Autumn Giant.
Broccoli: Roscoff types, Early Feltham, Satisfaction, St. George.

Diagnosis Whiptail can be diagnosed most effectively by an inspection of the visual symptoms and a study of the distribution of whiptail plants in the field. Regarding the latter point, the pH of a non-calcareous soil may vary considerably over a range from acid to neutral, and pockets of soil more acid than the rest will often show severe whiptail symptoms. Thus the occurrence of the trouble, in association with lower pH values than in the remainder of the field, will usually provide additional evidence of the deficiency.

Final proof can be obtained by comparing the content of molybdenum in whiptail plants with the amount found in healthy specimens. Leaves from whiptail broccoli or cauliflowers contain as little as 0.02–0.08 p.p.m. molybdenum (expressed on dry matter), whereas healthy leaves contain anything from 0.10 to 3.00 p.p.m. molybdenum. Results from many experiments indicate that comparisons between the molybdenum contents of healthy and whiptail plants in the same field give the most useful results for interpretation.

Corrective Measures Experiments in different parts of England and Wales have shown that whiptail can be corrected either by liming or by the application of a molybdenum salt such as ammonium or

CONTROL OF WHIPTAIL IN BROCCOLI AND CAULIFLOWER
 sodium molybdate. Two experiments carried out on broccoli (Roscoff No. 2) grown in Cornwall showed the following results :

CENTRE	SOIL pH (CONTROL)	TREATMENT									
		Control			Sodium Molybdate 2 lb. per acre			Sodium Molybdate 4 lb. per acre		Ground Limestone 3 tons per acre	
		M.	R.	W. (per cent)	M.	R.	W. (per cent)	M.	R.	W. (per cent)	M.
A	4.8	51	10	39	81	11	8	89	9	2	85
B	5.2	64	5	31	89	6	5	95	5	0	88
											5
											7

M = Marketable heads; R = Rejects; W = Whiptail

At Centre A (*pH* 4.8) 39 per cent of the plants on the untreated plot (control) were whiptails while at Centre B, where the *pH* was a little higher (5.2), 31 per cent of the plants were affected. The effect of sodium molybdate (2 lb. per acre) and limestone (3 tons per acre) gave the same results and reduced the incidence of whiptail to 5.8 per cent. Sodium molybdate at 4 lb. per acre reduced whiptails to 2 per cent at Centre A and completely eliminated the deficiency at Centre B.

An estimation of the molybdenum in the different treatments showed that whilst whiptail plants contained 0.08 p.p.m. molybdenum, the molybdate treatments and lime had raised the content fourfold to 0.35 p.p.m. It may be assumed that the molybdates supply molybdenum directly to the plant but the action of the lime requires explanation. The molybdenum content of lime has been estimated, and the amount found was so little that the quantity supplied to the soil in 3 tons of lime per acre could not account for the increase of molybdenum in the plants grown with this treatment. The effect of lime thus seems to be indirect, through increasing the availability of the soil molybdenum.

A similar experiment with cauliflower (Var : Majestic) gave the following results :

TREATMENT	Soil <i>pH</i>	Marketable heads	Rejects		Molybdenum
			<i>per cent</i>	<i>per cent</i>	
Control	4.8	10	15	75	0.06
Ground limestone 5 tons per acre	7.2	69	16	15	0.12
Ammonium molybdate 4 lb. per acre	5.1	70	15	15	0.12

The beneficial effects of ground limestone and ammonium molybdate were the same, and the incidence of whiptail on the control plots (75 per cent) was reduced to 15 per cent by these treatments. The effect of lime was to raise the soil *pH* considerably, and the molybdenum content of the

CONTROL OF WHIPTAIL IN BROCCOLI AND CAULIFLOWER

leaves from this treatment was double the amount found on the control and equal to the ammonium molybdate treatment at 4 lb. per acre.

Molybdate Applications A broccoli or cauliflower crop requires 5-10 grm. of molybdenum per acre for successful growth. Sodium molybdate at 2 lb. per acre supplies 450 grm. molybdenum, and this amount is thus ample for the crop if an even distribution can be made. In these trials sodium molybdate was dissolved in water and watered on to the plots. On a field scale, molybdates would be applied most effectively dissolved in water and sprayed on to the soil before planting at rates of 2-4 lb. per acre according to the soil conditions.

Liming When a new field or a piece of ground is allocated to growing these crops, a representative soil sample should be taken from the field for a laboratory determination of the pH. If the soil is acid, sufficient lime should be applied to raise the pH to 6.5-7.0. In the normal course of events the application of materials such as ground limestone or calcareous sand is the most practical method of liming, but where strongly acid land or ploughed permanent pasture is to be used, the necessity of raising the pH quickly would require the use of slaked lime. Since it would be impossible under such circumstances for the lime to penetrate quickly through the soil profile, broccoli or cauliflower should not be grown for at least one year after applying the lime.

Liming, in addition to raising the soil pH and making molybdenum more available, decreases the availability of manganese. On many acid soils, the effect of excessive amounts of manganese can interfere with crop growth, and there is reason to believe that molybdenum deficiency is accentuated by manganese toxicity. The important thing to bear in mind is that broccoli and cauliflower are more suited to soils with a high pH, and under such conditions the occurrence of whiptail is unlikely. Where liming, after raising the soil pH, has failed to effect a cure for whiptail, it may be assumed that molybdenum is deficient in the soil and the use of molybdates is necessary.

Molybdate Sprays The use of molybdate sprays in the event of whiptail occurring after it is too late to carry out liming has been investigated. Whiptail plants will recover if sprayed early in their development with a sodium molybdate solution ($\frac{1}{2}$ lb. in 100 gallons per acre) containing sufficient water to enable a good cover to be obtained. Whiptail cauliflowers would require spraying in early summer and broccoli in August-September. Late sprays, especially in the winter, are ineffective. The practice of watering the seedbed with a solution of sodium molybdate is now being tried and may result in a successful insurance against whiptail on acid soils.

Conclusions Molybdenum is an essential trace element for plant growth, and whiptail in cauliflower and broccoli results from a deficiency of this nutrient. All members of the brassica family are susceptible to the deficiency, but these two members are particularly sensitive. The amount required by a crop is very small, and it is most important to remember this when salts of molybdenum are being used. The deficiency is affected by climate, and drought periods accentuate the extent of symptoms. Soil acidity is conducive to the occurrence of the deficiency in the field, and although the total soil molybdenum may be adequate, the element may be comparatively unavailable under acid conditions. Wherever possible, liming should be the corrective measure, and when carried out during a crop

CONTROL OF WHIPTAIL IN BROCCOLI AND CAULIFLOWER

rotation should preferably be given to some crop preceding the brassica. If, after the soil pH has been raised to neutrality, whiptail has not disappeared, the use of sodium molybdate should be tried.

References

1. A Case of Molybdenum Deficiency in New Zealand. DAVIES, E. B. *Nature*, 1945, **156**, 392.
2. Whiptail in Cauliflower. JONES, J. O. and DERMOY, W. *Nature*, 1950, **165**, 248.
3. The Use of Lime and Sodium Molybdate for the Control of Whiptail in Broccoli PLANT. W. *Nature*, 1950, **165**, 533.
4. The Production of Molybdenum Deficiency in Plants in Sand Cultures with special reference to Tomato and Brassica crop. HEWITT, E. J. and JONES, E. W. *J. of Pomology and Hortic. Sci.*, 1947, **23**, 254.
5. Progress Report on Vegetable Diseases. VIII. OGILVIE, L. and HICKMAN, C. J. *Ann. Rept. Long Ashton Res. Sta.* 1936, 139.

COLORADO BEETLE IN ENGLAND, 1949

C. T. GIMINGHAM, O.B.E., B.Sc. and I. THOMAS, M.Sc., Ph.D.

Ministry of Agriculture Plant Pathology Laboratory, Harpenden, Herts

IN 1947, a year in which many beetles arrived in England with imported produce, there were 57 instances of Colorado beetle breeding on potatoes in England ; in 1948, 11 colonies were found and exterminated ; in 1949, no colonies were discovered. Finds of single beetles within the country in 1949 were fewer than in 1948, and the great majority were associated with imported produce. Once again a number of beetles, though fewer than in 1948, were found on cross-Channel shipping.

Finds of Single Beetles In 1949 the first live beetle was found on January 15 in a kitchen sink at Maidenhead and is believed to have been imported with Italian broccoli or with lettuce from the Perpignan district in the South of France. Subsequently, live beetles were found on Perpignan lettuce on March 9, 13 and 25 at Plumstead, South-East London, Wallington, Surrey, and Catford, South-East London, respectively. Imports of lettuce from nearly all Continental countries ceased on March 30, and the only live beetle found in April was at Wandsworth in South-West London ; this may have been associated with lettuce imported in late March. Three dead beetles were found in the early part of the year, one at Leytonstone, Essex, believed to be a stray beetle from 1948 ; one at Manchester in a consignment of Dutch lettuce, and one at Liverpool found among sacks of shelled almonds from Spain.

During May six live beetles were discovered, all on or associated with imported produce : three with strawberries from France—at Bradford-on-Avon, Southwark and Smithfield Market, Manchester ; one believed to have been imported with cherries from Italy—at Westcliff-on-Sea ; one in a greengrocer's shop at Leicester and one in a Leicester market. In May, also, a dead beetle was handed in to the Keighley police ; this had been found in the possession of a schoolboy who had been visiting his parents in Belgium.

COLORADO BEETLE IN ENGLAND, 1949

During June more single live beetles were found, mostly on imported produce. On the 2nd, one was discovered among vegetables in a grocer's shop at Blaenavon, Monmouthshire, and one with French strawberries at Covent Garden; on the 10th, three were found with French strawberries at Nottingham, Birmingham and Winchester and one at Hoyland, Yorkshire, with apricots from Spain; on the 16th, one in a fruit shop at Hull, just after a consignment of Belgian gooseberries and Italian plums had been received. Another single beetle was found on a bale of rags at Goole and a few on ships at the following ports: Goole—two beetles with a cargo of iron and steel from Antwerp; one at Rotherhithe with a cargo of timber; one at Cardiff with a cargo of iron ore, and another at Southampton in a ship with general cargo, including timber.

Throughout the remainder of the year until the end of September occasional single beetles continued to be reported on imported produce and merchandise, and in cross-Channel shipping. One live beetle was found on August 17 on the *Queen Mary* on a voyage from New York to Southampton. In all, 52 beetles were found, of which 27 were on or associated with imported produce and 17 intercepted on ships.

Breeding Colonies and Spraying Campaign No breeding colonies of beetles were discovered—a fact which suggests that the eleven colonies found in 1948 had been exterminated and it is unlikely

that any beetles survived in this country during the winter of 1948-49.

Since there were no breeding colonies in 1949, all the spraying done was of a precautionary nature and had been planned beforehand. All potatoes near the sites of colonies found in 1948 were sprayed as a routine measure, and, as in 1947, all potato crops in Kent, north of a line from Folkestone to Tonbridge, were dusted or sprayed. Other "danger" areas included were a strip of land immediately north of the Thames estuary and potato fields around the ports of King's Lynn and Harwich (see map p. 136).

The bulk of the spraying and dusting was done for the Ministry by Plant Protection Ltd., but one small area around Horsham in Sussex was sprayed by Pest Control Ltd. with a helicopter, and a small acreage of potatoes consisting almost entirely of very small plots around Evesham was dealt with locally by means of hand machines. Maps marking the potato fields in these areas were drawn up in early summer after surveys by teams of temporary workers, mainly from the Women's Land Army, under the supervision of advisory officers. Spraying of early potatoes began on May 16 and maincrop potatoes on June 11. A total of approximately 28,600 acres was treated, of which 5,000 acres were dusted and the remainder sprayed. The areas dusted were around King's Lynn (888 acres), around Harwich (227 acres), North of the Thames estuary (1,110 acres), West Kent early crop (650 acres), and West Kent maincrop (2,111 acres).

Both lead arsenate and DDT emulsion were used as low-volume sprays at 10 to 15 gallons per acre, the lead arsenate being applied in the early part of the season and the DDT emulsion later when there was a possibility of first generation beetles having appeared. 5 per cent DDT dusts were also employed.

The spraying and dusting was done with a fleet of twenty-seven tractor-mounted sprayers and six tractor-drawn dusting machines. Without allowing for breakdowns and bad weather, the spraying and dusting was done at an average of 28.23 acres and 38.84 acres per day respectively.

It will be seen that the 1949 campaign against Colorado beetle in England was conducted with the same intensity and on much the same scale as in 1948. The precautionary spraying alone involved much planning, but the

COLORADO BEETLE

AREAS SPRAYED

1949



Map showing the areas in which precautionary spraying or dusting of potato crops was carried out in 1949.

COLORADO BEETLE IN ENGLAND, 1949

campaign as a whole had other aspects necessitating, as in previous years, the recruitment of additional labour and the need for considerable supervision. For instance, all potatoes along the south and east coasts from Southampton to Harwich are scheduled for inspection, and particular attention is paid to the inspection of potatoes within half a mile of wharfs and quays where vessels from Continental countries are likely to berth. The possibility of beetles arriving by air is not overlooked, and every opportunity is taken of inspecting potatoes in the vicinity of aerodromes. Propaganda and educational work have been continued as in previous years, and now that more people have seen actual specimens of the beetle, the numbers of "suspects" sent in for examination tends to diminish.

Much of the success of the campaign so far is due to the co-operation of all concerned, especially the public, the police and the masters and crews of cross-Channel shipping. The National Farmers' Union and, in particular, farmers and gardeners in the south-east where spraying has been done, are thanked for their active co-operation. The Ministry also pays tribute to the excellent work of the temporary inspectors, including the Women's Land Army, and to the staff of Plant Protection Ltd., for the very efficient way in which they have conducted the spraying campaign over a number of years.

In spite of the fact that no breeding colonies of Colorado beetle were found in 1949, it is as important as ever to take all precautionary measures again in 1950, and a campaign as extensive as that undertaken in the past few years has been planned.

FARMING AFFAIRS

Nitrogen Fertilizer If this country is going to produce the extra amount of food of which she is capable, and with the dollar position as serious as it is, it seems probable that the fertilizer consumption must continue to increase. So said Mr. M. H. R. Soper (Department of Agriculture, Oxford) at last year's Agricultural Co-operation course. On the using of nitrogen fertilizer specifically, Mr. Soper said : "Nitrogen, being the principal constituent of chlorophyll, is of particular importance in carbon assimilation, and for increasing leaf area and vegetative development. It is therefore of especial value for leafy forage crops, and for root crops that demand a considerable carbohydrate assimilation for root storage. It is very easily absorbed through the roots of the plant, but this advantage is negatived by its rapid loss from the soil by washing out. The natural supply in the soil is derived from the breakdown of organic matter and by bacterial fixation, either in the roots of legumes or by free-living bacteria. The main symptoms of deficiency are chlorosis (yellowing) of the leaves, stunting of the plant and low yields, especially of brassica crops."

How much should be used in practice is a very difficult problem, owing to continual variations in soil and climatic conditions. The effect of nitrogen on crop yield is particularly sensitive to changes in rainfall. The average increase to be expected from the application of 1 cwt. ammonium sulphate was given some years ago by Russell as follows :

Cereals (grain)	2½-3 cwt.	Straw	5-6 cwt.
Potatoes	20 "	Kale	30 "
Sugar Beet	14 "	Hay	5 "

More recent figures quoted by Crowther suggest that these figures may be rather on the low side ; in any case such estimates can only be rather wide

FARMING AFFAIRS

approximations. If 1 cwt. of ammonium sulphate gives such an increase, do further additions give commensurate returns? The maximum response is soon reached with most crops, and, after that point, the rate of increase in yield declines. The difficult thing in advisory work is to judge at what application the optimum return is likely to be obtained and furthermore, at what rate of application the greatest financial advantage will be reaped by the farmer. In practice, for average soils, 1-2 cwt. of nitrogenous fertilizer per acre on cereal crops, 2-3 cwt. on maincrop potatoes and sugar beet, and 3-5 cwt. for root crops are fairly safe recommendations, though the average application is considerably lower than these figures, and too little nitrogen is used both on grass and arable land in this country."

Sulphate of ammonia, 20.6% N, is the most widely used of the nitrogenous group (over half a million tons in 1948). It stores well and is easy to apply, is quick acting but harmless to the crop, and can be put on at practically any time during growth. Its main disadvantage is a tendency to increase acidity in the soil through its removal of calcium, and it is therefore risky to use it indefinitely on a soil without adequate calcium reserves.

Nitrate of soda, 15.5% N, is very quick acting and of value as a top dressing, while the sodium might be a help to sugar beet and mangolds. Generally the material is very deliquescent and stores badly, but there has been an improvement in this respect. Usually it is a little more expensive per unit.

All fourteen papers read at the Course have now been published in booklet form under the title *The Farmer in Business*, obtainable from the Agricultural Co-operative Association, 14, Portman Square, W.1, price 1s.

Rothamsted Experimental Station Report for 1948

At Rothamsted, fundamental scientific research and *ad hoc* field investigations go hand in hand, the one often giving rise to the other. This linking of theoretical with practical matters is advantageous at all stages of an investigation, but the final step in agricultural research—that of applying experimental conclusions to general farming practice—is perhaps the hardest link of all to forge. The Station is noted, however, for its policy of repeating its experiments elsewhere, to see whether experimental results are applicable to different farming conditions. It is, therefore, specially interesting to note in the Report for 1948 a number of references to extra-mural work of this kind, chiefly in collaboration with the N.A.S. This side of the work of the Station is increasing and will no doubt continue to do so as the comparatively young Advisory Service gets into its stride.

The following brief notes deal with a few of the wide range of topics discussed in the Report:

Experiments at Rothamsted and at many outside centres on the much debated practice of deep ploughing show, mainly, that deep ploughing renders spring management easier; the land is cleaner, and earlier sowing is possible on the heavier soils. Further experiments are to be conducted to test these and other potential advantages of deep ploughing.

Fertilizer placement studies continue to throw more light on the way to use fertilizers with greater efficiency. Injury to germination, through the fertilizer coming into contact with the seed, varies with the crop. For root crops, it appears to be necessary to place the fertilizer bands more than one inch from the seed.

Field trials with straw composts have shown that these have a low manurial value. About the same amount of nitrogen becomes available in the soil, whether given amounts of straw and inorganic nitrogen are added direct to the soil or are previously composted, in order to rot the straw beforehand.

FARMING AFFAIRS

Bacteriological studies at Rothamsted include an interesting series of field trials comparing three strains of clover root nodule bacteria in order to determine which is the most likely to establish itself in competition with the local strains found in different parts of the country.

The progress report from the Botany Department refers to the completion of the long-term work on the vitality of buried weed seeds, including wild oat. It is hoped to begin an experiment on the control of wild oat which will test a number of suggestions received by Dr. Winifred Brenchley from farmers and others as a result of her appeal in the article* published in *Agriculture* in 1948. Dr. Brenchley retired from the headship of the Botany Department during the year under review, and there is a reference in the Report by the Director of Rothamsted to "her outstanding services to agricultural science and to the Station over a period of 42 years," which will be endorsed by all who have been in any way associated with her work.

Statistical methods used successfully in the Survey of Fertilizer Practice are being applied by the Statistical Department to new surveys, notably a survey of maincrop potatoes. This survey includes a test of a rapid method of estimating potato yields. Results obtained in 1948 indicate that the method is likely to be practicable and considerably more reliable than existing methods. Work is also in hand on a method of forecasting the potato crop a month or so before lifting time, by taking weighed samples of growing potatoes.

The customary Special Review deals with the serological reactions of plant viruses. The use of serological tests is also discussed in the report from the Plant Pathology Department.

The transfer of research work on plant nematology from the Institute of Parasitology, St. Albans, to Rothamsted was completed in June, 1948. The progress report by Dr. T. Goodey, who is head of the Department, includes some account of experiments on the control of potato eelworm. These trials indicate that something like a 50 per cent reduction of eelworm population may be expected when D.D. mixture (composed mainly of dichloropropylene and dichloropropane) is injected into soil at 800 lb. per acre, but this decrease is more than made good during the following growing season, owing to the increased rate of multiplication of the eelworm.

The setting up of long-term ley-arable field experiments, comparing permanent grass plus permanent arable with alternating grass and arable, is reported. These experiments are on the lines of those carried out at the Woburn Station since 1938. (It is hoped to repeat this type of experiment in other parts of the country with the assistance of the Advisory Service.)

Horticulturists as well as farmers will be interested in the account of irrigation experiments with sugar beet in 1947 and 1948 under the control of the Station. In the dry summer of 1947 irrigation increased the yield of clean roots by 9.66 tons to give a yield of 30 tons per acre. The yield of tops was increased a further 5.2 tons by irrigation.

Imports of Fresh Fruits and Vegetables The *Board of Trade Journal* for October 1, 1949 gave details of the decision of His Majesty's Government to issue Open General Licences for the importation into the United Kingdom from a number of countries of a wide range of goods as part of a general policy for the liberalization of intra-European trade. It was indicated at the time, however, that it might be necessary, in the light of the supplies available, to restrict the importation of fresh fruit and vegetables during the main season of home production. After consultation with the Ministry of Food and the Agricultural Departments, the

* Suggestions for the Control of Wild Oats. 1948, 55, 12-6.

FARMING AFFAIRS

Board of Trade has decided to suspend the operation of the Open General Licence for the various fresh fruits and vegetables listed below. Those items of which there is a limited importation (as shown in the third column) will be included for the periods specified in the block licensing arrangements already announced by the Ministry of Food. The quantities shown in the third column will be subject to review in the light of supplies available from home production. It may prove necessary in some cases, if home supplies are not enough, to shorten the period of restricted importation during which the Open General Licence is suspended.

	Period (inclusive) for suspension of Open General Licence	Import Quantity
		Tons
Asparagus	April 16 — June 30	300
Beans (green)	May 1 — June 30	150
Carrots (new)	July 1 — September 30	nil
Cauliflower and Broccoli	June 15 — July 31	nil
Cherries	March 16 — June 30	10,000
Cucumbers	July 1 — November 15	nil
Currants (black and red)	June 1 — July 31	6,000
Gooseberries	June 1 — July 31	4,500
Lettuce	June 16 — August 31	1,500
Onions (dry bulb)	June 16 — July 31	1,500
	May 16 — October 31	nil
	August 16 — November 15	nil
Peas (green)	(excluding pickling onions for manufacture)	
Plums	June 16 — July 31	nil
Potatoes (new)	July 16 — August 15	6,000
Radishes	August 16 — September 30	nil
Rhubarb	June 1 — July 31	nil
Strawberries	April 22 — May 31	nil
Tomatoes	April 16 — September 15	500
Turnips (new)	(excluding rhubarb for canning)	
	June 1 — July 31	2,500
	July 1 — July 31	7,200
	August 1 — August 31	2,300
	September 1 — October 15	nil
	May 1 — June 30	100

It is not proposed to suspend the present Open General Licences for the importation of chicory, endive and batavia, green onions, mushrooms, hothouse grapes, and hothouse peaches.

All imports of fresh fruits and vegetables covered by this announcement are subject to the provisions of the Importation of Plants Orders and of the Importation of Raw Cherries Orders made by the Ministry of Agriculture and Fisheries and by the Department of Agriculture for Scotland.

Correction to Advertisement.

In our May issue the advertisement for the Agricultural Mortgage Corporation showed the rate of interest on their loans as 3½ per cent per annum. This advertisement should of course have shown the current rate of interest as 4 per cent per annum.

AGRICULTURAL STATISTICS ENGLAND AND WALES

June, 1949, Agricultural Returns (Final Results)

CROPS AND GRASS

(thousand acres)

DESCRIPTION	1939	1948	1949
Wheat	1,683	2,188	1,899
Barley	910	1,897	1,885
Oats	1,358	1,992	1,946
Mixed Corn	83	588	670
Rye, for threshing	(b)	57	60
Rye, for green fodder	(b)	5	5
Total Rye	16	62	65
Beans, for stock feeding	133	80	102
Peas, for stock feeding	17	45	36
Potatoes, first earlies	56	222	217
Potatoes, main crop and second earlies	398	895	711
Total Potatoes	454	1,117	929
Turnips and Swedes for stock feeding	396(c)	355	339
Mangolds	210	272	267
Sugar Beet	337	405	413
Rape	53	104	117
Cabbage, Kale, Savoys and Kohlrabi, for stock feeding	94	189	206
Vetches	49	38	28
Lucerne	32	(d)	(d)
Mustard, for seed	24	17	15
Mustard, for fodder or ploughing in	24	21	22
Linseed	4	86	58
Flax, for fibre	19	23	22
Hops	19	23	22
Orchards, with crops, fallow, or grass below the trees	236	255	255
Orchards with small fruit below the trees	18	12	13
Small fruit, not under orchard trees	29	28	35
Vegetables, for human consumption (excluding potatoes), crops under Glass and Flowers	275	583	538
Fruit and vegetables, grown for consumption by persons living on the holding	(b)	(b)	7
All other crops	32	45	43
Bare fallow	355	238	301
TOTAL OF CROPS AND FALLOW (FELLAGE)	6,862	10,682	10,227
Clover, Sainfoin and Temporary Grasses for mowing	1,304	2,079	2,320
Clover, Sainfoin and Temporary Grasses for grazing	768	1,378	1,376
Total Temporary Grass	2,072	3,457	3,696
TOTAL ARABLE LAND	8,935	14,109	13,924
Permanent Grass for mowing	4,612	2,655	2,634
Permanent Grass for grazing	11,097	7,608	7,822
Total Permanent Grass	15,709	10,263	10,456
TOTAL ACREAGE OF CROPS AND GRASS (a)	24,643	24,373	24,380
Rough Grazing—Sole rights	4,179	4,118	4,031
Common	1,361	1,441	1,501(e)
Total Rough Grazing	5,541	5,559	5,532

(a) Excludes rough grazing.

(b) Not separately returned.

(c) Includes Turnips and Swedes for human consumption.

(d) Included under "Temporary Grass".

(e) Provisional.

AGRICULTURAL STATISTICS : ENGLAND AND WALES

SMALL FRUIT, VEGETABLES AND FLOWERS
(*thousand acres*)

DESCRIPTION	1939	1948	1949
Strawberries	18.7	16.1	20.1
Raspberries	4.1	2.8	3.8
Currants, Black	10.4	12.4	15.3
Currants, Red and White	2.3	1.5	1.7
Gooseberries	9.1	6.1	6.5
Loganberries and cultivated Blackberries	2.5	1.1	1.0
TOTAL SMALL FRUIT	47.2	39.9	48.4
Brussels Sprouts	38.0	54.7	45.7
Remaining Spring Cabbage (planted in previous year)		12.2	14.2
Summer Cabbage		11.5	10.1
Autumn Cabbage		8.4	6.4
Winter Cabbage	44.1	17.2	13.6
Autumn Savoys		6.2	4.1
Winter Savoys		17.0	12.8
Kale and Sprouting Broccoli		2.5	2.4
Cauliflower or Broccoli (Heading)	18.9	34.4	26.3
Carrots	16.1	34.6	31.8
Parsnips	(a)	8.9	5.4
Turnips and Swedes	(a)	9.2	7.9
Beetroot	(a)	11.1	8.6
Onions grown for salad		1.7	1.9
Onions for harvesting dry		14.8	
Beans, Broad		6.2	6.5
Beans, Runner and French	17.8	12.8	10.2
Peas, Green for Market	60.6	54.4	51.1
Peas, Green for Canning		22.8	25.4
Peas, Harvested Dry	28.0	180.2	180.2
Asparagus	2.6	1.7	1.7
Celery	6.7	6.1	5.7
Lettuce	5.9	7.5	7.1
Rhubarb	7.2	8.5	9.2
Tomatoes (growing in the open)	0.2	3.2	2.4
Other vegetables growing in the open	(a)	14.4	15.3
All Crops growing in Glasshouses		3.7	4.2
All Crops growing in Frames	3.3	0.5	0.6
TOTAL VEGETABLES (excluding Potatoes)	251.0	564.8	517.9
Hardy Nursery Stock	10.5	8.3	9.6
All Bulb Flowers, not under glass	7.7	4.0	4.6
Other Flowers not under glass	5.8	5.7	6.2
TOTAL FLOWERS	24.0	18.0	20.4

(a) Not returned.

LIVESTOCK

(*thousand head*)

DESCRIPTION	1939	1948	1949
Cows and heifers in milk	2,255	2,278	2,369
Cows in calf but not in milk	392	516	513
Total	2,646	2,794	2,882
Heifers in calf, with first calf	459	709	721
Bulls for service	91	104	100
Bulls (inc. bull calves) being reared for service	43	45	41
<i>Other Cattle two years old and over:</i>			
Male (Steers)	(a)	438	454
Female	(a)	628	625
Total	944	1,066	1,079

AGRICULTURAL STATISTICS : ENGLAND AND WALES

LIVESTOCK (thousand head) contd.

DESCRIPTION	1939	1948	1949
<i>Other Cattle one year old and under two.</i>			
Male (Steers)	(a)	276	338
Female	(a)	889	961
Total	1,346	1,165	1,298
<i>Other cattle under one year old (excluding bull calves being reared for service).</i>			
Male (Steers)	(a)	356	408
Female	(a)	1102	1165
Total	1,242	1,458	1,573
TOTAL CATTLE	6,770	7,340	7,695
<i>Sheep one year old and over.</i>			
Rams for service	205	119	129
Ewes for breeding	7,160	4,317	4,460
Two-tooth (shearing) ewes	1,477	901	1,095
Other sheep one year old and over	1,021	806	893
Total one year old and over	9,863	6,143	6,576
<i>Sheep under one year old.</i>			
Ram lambs for service	156	69	69
Other sheep and lambs under one year old	7,967	4,647	5,099
Total	8,123	4,716	5,169
TOTAL SHEEP AND LAMBS	17,986	10,858	11,744
Sows in pig	(a)	99	124
Gilts in pig	(a)	75	58
Other sows for breeding	(a)	75	81
Total sows for breeding	449	249	263
Barren sows for fattening	(a)	13	17
Boars for service	30	15	16
Young boars being reared for service	(a)	9(8.6)	6(6.3)
<i>All other pigs.</i>			
Five months old and over	633	395	654
Two to five months	1,516	560	725
Under two months	888	391	450
TOTAL PIGS	3,515	1,632	2,132
<i>Fowls :</i>			
Six months and over	23,154	19,596	23,959
Under six months	29,758	28,268	33,033
Fowls, Total	52,912	47,863	56,991
Ducks, Total	2,237	2,335	2,521
Geese, Total	584	913	938
Turkeys, Total	693	742	800
TOTAL POULTRY	56,426(b)	51,853	61,250

(a) Not separately returned.

(b) As a result of war time methods many small sized holdings were recorded for the first time in 1941. It is estimated that to make the totals prior to 1941 reasonably comparable with later years some 2 or 4 million head should be added in England and Wales.

Horses used for agricultural purposes :

Mares (including those kept for breeding)	347	224	199
Geldings	202	160	136
Unbroken horses of one year old and over			
(Light)	110	{ 17	16
(Heavy)		{ 30	19
Horses under one year old			
(Light)	15	7	7
(Heavy)	35	7	5
Stallions being used for service			
(Light)	5(4.6)	{ 1(1.0)	1(0.9)
(Heavy)		{ 1(1.3)	1(1.0)
All other horses (not entered above)	132	90	86
TOTAL HORSES	846	538	470

AGRICULTURAL STATISTICS : ENGLAND AND WALES

LABOUR (thousands)

DESCRIPTION	1939	1948	1949
<i>Regular Workers</i>			
Male, 65 years old and over	375.1	27.6	27.1
" 21 years old and under 65	391.6	411.2	
" 18 to 21 years old	44.7	47.4	47.9
" under 18 years old	50.8	39.9	41.5
Total	470.8	506.5	527.7
Women and girls	40.3	57.3	56.0
Total Male and Female	511.1	563.8	583.7
<i>Women's Land Army</i>			
<i>Prisoners of War</i>	—	16.5	11.2
<i>Casual Workers</i>			
Male, 21 years and over	57.4	90.4	98.8
" under 21 years old	5.9	8.4	9.2
Total	63.3	98.8	106.0
Women and Girls	32.7	50.4	47.7
Total Male and Female	96.0	149.1	153.7
Total Male Workers	534.1	616.7	633.7
Total Female Workers	73.0	124.1	114.9
TOTAL WORKERS	607.1	740.8	748.6

COMMONWEALTH AGRICULTURAL BUREAUX

RECENT TECHNICAL COMMUNICATIONS

The Production and Utilization of Silage. A Review of World Literature in Abstracts. 1950. 10s.

While it has not been possible to produce a balanced review of the whole problem, abstracts of all papers and other publications which have appeared over a period of some fifteen to twenty years have been brought together, in order that this may serve as a reference book to the very extensive literature.

Recent Advances in Fruit Juice Production. V. L. S. CHARLEY and OTHERS. 1950. 15s.

In this publication experts combine in filling out in detail the latest discoveries in technique of production, particularly as they affect methods of deeration and clarification; concentration; retention of vitamins and the fortification of juices with these accessory food factors; and the function and use of enzymes in modern juice production.

The Establishment of Vegetation on Industrial Waste Land. R. O. WHYTE and J. W. B. SISAN. 1950. 10s.

This publication is the ultimate outcome of a study of the problems and techniques of reclamation of industrial waste land by the study of vegetation. The great majority of the information has been collected from unpublished sources from those who have undertaken the work or are interested in its execution.

All correspondence regarding the above technical communications should be addressed to : Commonwealth Agricultural Bureaux, Central Sales Branch, Penglais, Aberystwyth, Wales.

BEEKEEPING STATISTICS, 1948-49

The following Table shows, by counties, the number of beekeepers who applied to the Ministry of Food for allowances of sugar for feeding to bees during the period August, 1948—January, 1949, together with the number of colonies of bees declared by them.

ENGLAND

County	No. of bee-keepers	No. of colonies	County	No. of bee-keepers	No. of colonies
Bedford	952	5,836	Stafford	1,508	8,135
Berkshire	2,063	10,721	Suffolk	2,806	16,939
Buckingham	1,509	7,586	Surrey	3,618	13,302
Cambridge and Isle of Ely	950	8,253	Sussex	4,122	20,174
Chester	1,678	8,150	Warwick	2,373	11,467
Cornwall	2,152	12,812	Westmorland	435	1,668
Cumberland	1,575	7,164	Wiltshire	2,057	14,149
Derby	1,099	4,875	Worcester	1,644	9,710
Devon	3,785	19,860	Yorkshire (East and West Riding)	4,053	22,970
Dorset	1,872	9,408	Yorkshire (North Riding)	1,948	11,129
Durham	1,122	5,131	Total England	81,127	436,196
Essex	4,117	20,833			
Gloucester	2,232	13,043			

WALES

County	No. of bee-keepers	No. of colonies
Anglesey	214	801
Brecon	162	985
Caernarvon	347	1,596
Cardigan	708	3,105
Carmarthen	938	4,197
Denbigh	440	2,024
Flint	273	1,742
Glamorgan	766	3,617
Merioneth	228	927
Monmouth	756	3,832
Montgomery	292	1,168
Pembroke	721	3,604
Radnor	106	605
Total Wales	5,951	28,203
Total England and Wales	87,078	464,399

THE MINISTRY'S PUBLICATIONS

Since the date of the list published in the March, 1950, issue of AGRICULTURE (p. 596), the undermentioned publications have been issued.

Bulletins Copies are obtainable at the prices mentioned from the Sales Offices of H.M. Stationery Office or through any bookseller.

No. 60. Asparagus (New) 1s. 6d. (1s. 8d. by post)

No. 133 Apples and Pears (Revised) 3s. 6d. (3s. 9d. by post)

No. 144 Bee-Hives (New) 9d. (10d. by post)

THE MINISTRY'S PUBLICATIONS

Leaflets Single copies of not more than 16 leaflets (four in any one group) may be obtained, free of charge, on application to the Ministry, 1-3 St. Andrew's Place, Regent's Park, London, N.W.1. Copies beyond this limit must be purchased from the Sales Offices of H.M. Stationery Office, net price 1d. each (2d. by post), or 9d. per doz. (11d. by post).

Advisory Leaflets

Group I. Livestock and Dairying.
No. 361. The Essentials of Good Cowmanship (New).

Group VI. Other Subjects
No. 358 Onions (New).

Animal Health Leaflets

No. 35 Fowl Typhoid (New).

Fixed Equipment of the Farm*

No. 1 Cowhouses in Modern Practice (New).

Other Publications

Domestic Food Production Report of a Committee on Organization (New).
Is. (1s. 1d. by post).

* A new series emanating from the Agricultural Land Service. Single copies may be obtained, free of charge, on application to the Ministry, 1-3, St. Andrew's Place, Regent's Park, London, N.W.1. Larger quantities must be purchased from the Sales Offices of H.M. Stationery Office, net price 3d. each (4d. by post), or 2s. 6d. per doz. (2s. 7d. by post).

CROP PROTECTION PRODUCTS APPROVAL SCHEME

Following the extension of the scheme described in the February, 1950, issue of **AGRICULTURE** (p. 546), the Ministry of Agriculture and Fisheries and the Department of Agriculture for Scotland are now prepared to receive applications for the official approval of proprietary products in the following groups :

Fungicides. Chlorinated nitrobenzene preparations.

Weed-killers. Sulphuric acid, sodium chlorate (98 per cent), technical 2, 4-dichlorophenoxy acetic acid, technical sodium 2, 4-dichlorophenoxy acetate and preparations based on sodium chlorate, on the sodium salt of 2-methyl-4-chlorophenoxy acetic acid and on the sodium and amine salts of 2, 4-dichlorophenoxy acetic acid.

Other groups of weed-killers are under consideration and will be included later.

The groups of crop protection products in which applications have so far been invited were given in **AGRICULTURE** 51, 402 ; 52, 47, 527 ; 53, 414 ; 54, 552. Application forms may be obtained from the Secretary of the Advisory Committee, Plant Pathology Laboratory, Milton Road, Harpenden, Herts.

BOOK REVIEWS

Elementary Veterinary Science (6th edition). H. THOMPSON (Revised by A. C. Duncan). Baillière, Tindall and Cox. 15s.

The sixth edition of this popular text book of elementary veterinary science contains much valuable information which the author, with his long experience of veterinary medicine and as a teacher at the Royal Agricultural College, is well qualified to present. The book is not intended for the use of veterinary surgeons.

A brief introduction to the elements of pathology, parasitology and pharmacology are included with some valuable information upon methods of restraint and of controlling animals for handling and examination; there are also useful chapters on shoeing and dentition.

Considering the very great reduction in the number of horses kept on farms and the increasing importance of the dairy cow during the past fifteen years (i.e., since the last edition appeared) it is somewhat surprising that such prominence has still been given to the anatomy, the common diseases and unsoundnesses of the horse and relatively so little space to those of the dairy cow. Perhaps more space could profitably have been given to animal parasites and their control, particularly the stomach worms of sheep, which are responsible for such serious losses to the sheep farmers and which can be controlled so successfully by the application of control methods and specific therapeutics. The influence of nutrition upon the incidence of animal disease and preventive veterinary medicine might have received greater prominence. One is impressed by the authoritative manner in which the author makes many of his statements, which are obviously the result of much practical personal experience.

Veterinary teachers of agricultural students have felt for some time there has been a need for a modern textbook on veterinary hygiene, and until the subject is presented in an entirely new manner, with emphasis on the practical prevention methods necessary to keep farm animals healthy and giving priority to the dairy cow, Thompson's *Elementary Veterinary Science* will continue to be the most popular book on veterinary science for agricultural students.

The author is to be congratulated upon presenting a concise book containing much practical advice on veterinary matters which will be welcomed by agricultural students, farmers and stock-keepers.

K.D.D.

The Story of Bovine Tuberculosis. STANLEY M. FORSYTHE. C. and J. Temple. 10s. 6d.

There was originally some difficulty about the choice of title for this book. It was to have been "Your Enemy the Cow" but this, on reflection, was considered by the author to be inappropriate.

It is doubtful if the present title is a particularly happy one either, for even the author in his notes says that the purpose of the book is to give an outline survey of tuberculosis as it affects man and to focus attention on conditions amongst domestic cattle. Rather is this book the story of human tuberculosis with special reference to milk contaminated with germs of bovine origin.

To make a story attractive different methods are commonly employed; one is to tell it "big," another is to tell it only half as big as it is, and another, if one is extremely competent and very confident, is to tell it exactly as it is. The first method has been used by the author and he has succeeded in presenting an arresting account. Copious use has been made of abstracts from well-known books and articles on the subject, and these, together with quotations from political speeches, etc., have been arranged in such a way as to shock, and perhaps alarm, the innocent reader.

Not all the views put forward are wholly unassailable from the point of view of their acceptance as scientific facts. An example, taken at random, of an expression of opinion by the author is to be found on page 130; it reads, "Bacillus Tuberculosis cannot live in the well-nourished healthy body, a fact which appears to have been appreciated to some good purpose in Soviet Russia."

The first assumption can be shown to be untenable, and the evidence for the second, as set out in the text, is that in Russia Bacillus Tuberculosis suffered defeat in company with its allies—malnutrition, squalor, poverty, etc. This is, of course, another story.

Notwithstanding inaccuracies and exaggerations which may be regarded as trivial in the context of the problem of tuberculosis, the book deserves to be widely read. If there is anyone who doubts the wisdom of the Government's declared policy for the eradication of tuberculosis from cattle from the Animal Health point of view, it is unlikely that he, or she, will remain unconvinced of its desirability from the Public Health aspect.

A.D.J.B.

BOOK REVIEWS

The Fruit, the Seed and the Soil (Collected John Innes Leaflets, prepared by the staff of the John Innes Horticultural Institution). Second Edition. Oliver and Boyd. 8s. 6d.

The reappearance in revised and extended form of the collected leaflets published by the John Innes Horticultural Institution is very welcome. Not all the leaflets will be of such practical value to professional horticulturists as others; their inclusion in the booklet, however, gives not only food for thought, but also an indication of the lines of research being conducted at the Institution, and serves as a reminder to us all that our attention should be kept firmly focused upon the results accruing from this research and the possible application thereof to horticultural practice. The treatment of plants with colchicine to induce polyploidy is a case in point, but the remainder of the leaflets are of the utmost possible practical importance to all who grow for pleasure or profit. The work carried out at Merton on composts, soil sterilizing and the design of soil sterilizers is now fairly well known, but far too few growers practise the recommendations outlined in the first three leaflets. Raising plants in soil blocks is another development of recent years which is also dealt with faithfully. Perhaps the most valuable of all the leaflets is that entitled "The Fertility Rules in Fruit Planting," which contains the sum of modern knowledge on compatibility of cherries, and the rules for interplanting varieties of plums, apples and pears to ensure the maximum cross-pollination. This knowledge is essential to all who grow fruit. Valuable work on tomatoes, too, has been done at the Institution, and the results are included, together with an informative leaflet on growing pure seed and the cultivation of sweet corn in England. To say that no grower can afford to be without this publication may seem a trite remark, but it is nevertheless a statement of plain truth.

R.H.

Fruit Growing for Amateurs. Plant Protection Ltd. 8s. 6d.

I am sure there are very few garden lovers who would disagree with the sentiment contained in the delightful quotation from Cicero which is found at the beginning of this book: "If you have a garden and a library nothing is lacking".

The book is very ambitious and covers the usual fruits grown by the average amateur, but in addition also includes in Chapter VI medlars, quinces and mulberries, and in Chapter XI cobnuts, filberts, walnuts, figs and grapes—the latter as an open-air crop.

There are 14 coloured plates, illustrating certain well-known varieties of apples and, better still, the more common pests and diseases that reduce the yields of our popular fruits. I do not know if pests and diseases lend themselves better for coloured illustrations than fruit, but certainly it is more important in the recognition of these garden enemies.

In the introduction it is stated that this is the first of a new series of horticultural publications by Plant Protection Ltd. This first book has set a high standard which may be difficult to maintain in other subjects, for the development of modern fruit culture has been based largely on, and directed by, scientific research and investigations, many of a fundamental character, while other horticultural spheres have received less attention from the research worker.

Thirty-five of the 128 pages are devoted to apples, since this fruit is basically the more important it is a fair proportion. In the first paragraph the statement that Ribston Pippin (of French origin) is of fine flavour in October needs some augmentation, because this variety is at its best for dessert from November to March. According to Hogg "the original tree was first discovered growing in the garden at Ribston Hall, near Knaresborough, but how, when or by what means it came there has not been satisfactorily ascertained. One account states that about the year 1688 some apple pips were brought from Rouen, and sown at Ribston Hall, the trees produced from them were planted in the park, and one turned out to be the variety in question."

In dealing with Malling apple stocks it is doubtful if Type IV is coming into favour, though it is good to see Malling VII included. Bush apples are rather closely planted at 12 feet. In commercial orchards on M II a better distance is 20 feet.

In the strawberry section Early Cambridge is not "a very early variety," being a few days later than Royal Sovereign. Its flowers are exposed and not protected from late spring frosts. Perle de Prague was not "brought to England during the war years by a Czech refugee." It was first grown by Mr. C. Jessell near Romsey in 1938. In the control of Needle Bug or Elephant Fly in the South of England, applications of DDT give the best control if dusted during the first ten days in April—not in early May.

The virus disease of logans, hybrid berries and blackberries known as Dwarf is worth including, as well as the wisdom of propagating stocks free from this malady.

The above criticism does not militate materially against the general usefulness of a very attractive and useful book for the amateur producer.

C.H.O.

BOOK REVIEWS

Chemistry and Uses of Insecticides. E. R. DeOng. Reinhold Publishing Corporation (New York). 36s.

Dr. DeOng is a well-known American authority, and a wealth of information, of particular interest and value to the specialist worker in crop protection, is contained in his book. It is attractively produced, and admirably serves its stated purpose of cataloguing the many materials now employed.

The emphasis is on pest and disease control in agriculture, but the uses in other fields of insecticides and allied materials are also given. References are made, for example, to the control of household pests, stored products pests, insects of medical importance, and rodents. Fungicides and weed-killers are also included. The author, after discussing the difficulty of selecting a suitable title, has grouped the various classes of materials under the generic term "insecticides". It seems a pity that the title chosen does not give a better indication of the comprehensive nature of the book.

An introduction deals with the development of pest control measures, and chapters are devoted to arsenic, copper, sulphur and their compounds inorganic materials, mineral and other oils, fumigants and fumigation, plant derivatives, synthetic organic compounds, and the effects of heat, cold and radiation. Each chapter contains an extensive list of references. The information is necessarily presented in condensed form, which makes the book an excellent reference work but not easily readable. The mass of information included in it has presented the author with a formidable task in preparing an index, and omissions, particularly of pests or weeds referred to in the text, have been noted. The book concludes with a dictionary of materials used in pest control and a number of appendices dealing with such questions as the U.S. legal requirements covering the manufacture and sale of insecticides, the official antidotes of the California State Board of Pharmacy, the physical and chemical characteristics of diluents, and other useful information.

J. T. M.

Agricultural Economics. BENJAMIN HORACE HIBBARD. McGraw Hill. 30s.

Through such books as this an ever-widening knowledge of the field of agricultural endeavour becomes possible, but it is a sign of the magnitude of that field that this book can contain little about agriculture or economics and yet be educational and informative, making a niche for itself in dealing with farmers' organizations and post 1919 agricultural legislation. Technicalities are concealed by the author's style, which is direct and reminiscent of the "fireside chat" manner of the late President Roosevelt. The material is largely drawn from experience, is presented without recourse to mathematics, and composed into a survey as distinct from an analysis. The background sciences are important in their practical application only. Consequently some among the wide range of topics covered lack reasoned or convincing treatment. These features make the book a work of reference rather than a plain textbook.

Nevertheless it contains a wealth of social, political and economic facts for the threshing ; and the author's intimate knowledge aids understanding of the social influences behind economic characteristics. For example, the size of farms is partly governed by the fear that a hired man may teach the farm children his own vocabulary, manners and morals, so the individual farm tends not to expand up to the point at which his labour becomes essential.

Perhaps the most interesting parts of the book are those relating to intensity of production and land tenure. In the former the author argues that (in a situation in which land and capital are unwisely free) the effective upper limit to intensity of production on farms is the enterprising ability of the operator. This is an advance on the land-use concepts of fifty years ago, but unfortunately intensity can still only be measured in its economic expression.

In the sections on land tenure an interesting relation between type of farming and tenancy is revealed by some admittedly historical records. Even in 1940 share-renters outnumbered cash-renters in 31 out of 48 States. Generally speaking, rented farms are larger than owner-operated farms, but are less intensive. Ownership comes with higher capitalization or greater specialization. Only 2 per cent of the Californian orange crop is grown by tenants, whilst 53 per cent of the land in the wholly grain counties of the Middle West is on rented farms. The decline in overall tenancy to 32 per cent in 1945 is seen to be associated with increases in numbers of livestock on farms.

All in all this volume relieves agricultural economics of many of its complexities and contributes valuable social data. The later chapters present the picture of a runaway U.S. agriculture moving down from 1919 to 1932, and recovering uneasily to 1939 in readiness for its war-time contribution—for which we have much cause to be grateful.

R. R. W. F.

BOOK REVIEWS

The Student's Handbook to the Science of Milk and Milk Products. L. T. Lowe and J. M. GOLDIE. Littlebury. 12s. 6d.

There is a dearth of up-to-date textbooks suitable for dairy students, and this little book, written in note form and with skilful avoidance of the use of scientific terms, will be welcomed especially by farm institutes for whose use it is primarily intended. It is all the more unfortunate, therefore, that the book contains many errors. The section on dairy chemistry is clearly expressed, the fundamental points being well illustrated by direct reference to dairying examples.

A striking omission is the lack of adequate mention of the serious fall in the solids-not-fat content of milk supplies in recent years, and of modern work on this subject. A few errors have also crept in, such as the statement made without qualification that there is no legal standard for cheese and in the figures given for the moisture content of milk powder. The legal time-temperature requirements for holder pasteurization are given incorrectly throughout the book, and there is some confusion in the interpretation of phosphatase results. The brief description of condensed and evaporated milk manufacture is inadequate and in some respects misleading—a criticism that may be applied to all the references to dairy technology. A sound presentation of such matters would necessitate a larger book.

The section dealing with bacteriology makes little attempt to present a basic picture of dairy bacteriology and its modern applications. Possible defects in milk and its products are listed together with the causal organisms (not always accurately), but with little indication of their relative importance or incidence. A general classification of bacteria, in simple form, would have been useful. More attention might also have been given to the general bacteriology of liquid milk distribution and the cleaning of dairy plant, milk cans, and milk bottles.

Errors include inaccurate particulars of the official standards for pasteurized milk and the statement that samples are taken every two months, under the National Milk Testing Scheme, instead of every two weeks : the use of the long obsolete term *Penicillium glaucum* and the suggestion (now discredited) that pasteurized milk becomes putrid rather than sour. Again, while reference is made to milk-borne botulism (a very rare occurrence), the relatively common occurrence of *Salmonella* or staphylococcal food poisoning is not mentioned. Discussion of the interpretation of various test results is not very satisfactory, particularly with regard to dye reduction and coliform tests. The author appears to accept an outmoded interpretation of the coliform test as applied to milk, and fails to indicate the essential differences between milk and water examinations.

The section dealing with laboratory testing methods should be extended in any future edition to include full descriptions of the techniques selected. The instructions given are inadequate for the novice to obtain any results of value, and some essential procedures are omitted altogether. It may be noted that the milk is not included in the recipe for standard Yeastrel Milk Agar medium (the word "Yeastrel" is misspelt throughout), and a Durham's tube of very unsatisfactory dimensions is illustrated for use in the coliform test.

The general impression is that the student would be tempted to memorize a miscellany of assorted bacteriological facts without gaining any real understanding of their significance.

E.L.C.

"AGRICULTURE"

Price 6d. net monthly, post free. (Foreign countries, 8d. post free).

Subscription Rates (including postage) :

Inland and Imperial 6s. per annum

Foreign Countries 8s. per annum

*Subscription may start with any issue
and should be sent to*

H.M. STATIONERY OFFICE,

Vaux House, Kingsway, London, W.C.2; 13a Castle Street, Edinburgh, 2;
89 King Street, Manchester, 2; 2 Edmund Street, Birmingham, 5;
1 St. Andrew's Crescent, Cardiff, Tower Lane, Bristol, 1;
80 Chichester Street, Belfast

Single copies can be purchased from any of the above-mentioned addresses
or through a bookseller.

Printed in Great Britain under the authority of HIS MAJESTY'S STATIONERY OFFICE
by Staples Press Limited at their Kettering, Northants, establishment.

CATERPILLAR for Economy Every Time!

Regd. Trade-mark

Say Farmers
who know!

With 'Caterpillar' firm-gripping tracks you get drawbar pull with no power-wasting wheelspin. With sturdy 'Caterpillar' Diesel engines you enjoy thousands of hours of trouble-free service on the most economical of all fuels. That's the secret of power with economy — helping 'Caterpillar' farmers everywhere to farm more acres at less cost.

"Aye it saves on fuel costs!"



Mr. Eric Dring, who farms near Boston, Lincs, says—"I never want to change from 'Caterpillar.' My D4 is still doing a wonderful job. I shall certainly choose 'Caterpillar' again."



LEVERTONS FOR 'CATERPILLAR'

H. LEVERTON & CO LTD • BROAD STREET • SPALDING • LINCS

Red Spider?

For RED SPIDER, APHIS,
SAW-FLY on APPLES,
PLUMS, HOPS,

USE
PETHANE
A PARATHION PRODUCT

for particulars and prices apply:

W.J.CRAVEN & Co.Ltd.
EVESHAM, WORCS.



**Wolseley
BELL
SHAPE
FENCER**



The Bell Shape Fencer is the latest addition to the Wolseley range and has been designed expressly for the successful operation of the Rotational Grazing and Kalo folding systems. This fencer is a complete unit, easily transported and quickly installed. No screws or bolts, fixed in a few seconds.

WOLSELEY

WOLSELEY SHEEP SHEARING MACHINE Co. Ltd.
WITTON • BIRMINGHAM • 6

Please mention the JOURNAL when corresponding with Advertisers

BY APPOINTMENT
MANUFACTURERS OF MILKING MACHINES TO H.M. KING GEORGE VI



For completely trouble-free milking there's nothing to equal the **Gascoigne Mobilactor System**. A mobile Auto-Recorder for use in existing cowsheds, it passes the milk from cow to churn under vacuum seal, weighs, cools, and stores it in a fraction of the time taken by manual labour—and at a fraction of the cost. And now the **Mobilette**—Gascoigne's new 2 point Mobile milking machine especially designed for use in smaller-sized cowsheds—brings the **Mobilactor System** within the reach of every farmer in the land. Send today for full details, or ask your local dealer for a demonstration.

GASCOIGNES

BERKELEY AVENUE · READING

Telephone: 5067 & 2273

Please mention the JOURNAL when corresponding with Advertisers



THE INCORPORATED SOCIETY OF AUCTIONEERS AND LANDED PROPERTY AGENTS

Agricultural Practitioners' Examination

This examination for agricultural auctioneers and valuers is held annually in the Spring at Intermediate, Final and Direct Final levels.

Full details of the examinations syllabus, tuition facilities, and conditions of membership may be obtained from the Secretary, at the Society's Headquarters,

34, QUEEN'S GATE, London, S.W.7
Telephone: Western 0034/5

SEED POTATOES

From the best stocks in Scotland,
Northern Ireland, England or Eire

J. JOHNSON & SON, LTD.

(Established 1870)

GROWERS, EXPORTERS and MERCHANTS

Head Office : Great Nelson Street, LIVERPOOL. Phone: North 2077 8-9

Branch Offices : The Granary, METHVEN, Perth, Scotland. Phone: Methven 236

Lawrence Hill Arches, BRISTOL 5. Phone: Bristol 57695

Water Street, LONDONDERRY, N.I. Phone: Londonderry 2738

The Square, KILKEEL, Co. Down, N.I. Phone: Kilkeel 331

Smethwick, Upton Magna, SHREWSBURY. Phone: Crosshouses 259

Also HAVERFORDWEST and CAMBRIDGE

Experimental plots open for inspection on our own farm in Cheshire. All seeds packed under our celebrated "SUN BRAND" design.

SEED POTATOES are a matter of trust between buyer and seller, so place your orders with an old-established reliable House!

If you are interested in quantities of less than 6 cwt. and down to 14 lb. of any variety, please write our Associate Company—S. & W. YOUNG LIMITED, SEED POTATO MERCHANTS, GT. NELSON STREET, LIVERPOOL 3, who handle exclusively our Seed Potatoes in small quantities.

No more MUDDY FARM YARDS



LAY YOUR OWN
CONCRETE
BY THE

CHEECOL

Patent No. 554853

EASY WAY

You can mix your own batches at times when it can be gained from other work, and you will
**SAVE 50% LABOUR,
50% TIME, 33% COST**
over normal methods of mixing.

* Our technical services are

available to you. Write AT

ONCE for full particulars and

over 1000 catalogues sent

free on request.

CHEECOL PROCESSES LTD.

Keeland House, 644 Oxford Road, Reading

Telephone: Reading 6013

Licences for Scotland: J. & W. Henderson, Upper Quay, Aberdeen



Royal Show · Oxford

4th to 7th July 1950

Wherever business or personal requirements demand a full and convenient banking service the Westminster Bank is ready to meet these needs. At this agricultural show, and at others, we are therefore establishing a showground office where banking facilities will be available to all.

WESTMINSTER BANK LIMITED

What are you doing about weedy pastures?



If you are far-seeing you will kill the weeds with **SHELL WEED KILLER D**. This selective weed killer is non-poisonous and is specially designed for the economical destruction of weeds in grass and cereals. It controls Ragwort, Creeping Thistle, Buttercup, Plantain and many other common weeds, but useful mineral-rich herbs such as Yarrow are left, and the grasses unharmed. **SHELL WEED KILLER D** is one of the Shell range of weed killers now revolutionising modern farming methods and increasing yields. Learn more about them all.

SET ABOUT IT THIS WAY: Write to Shell Technical Service for details of Shell selective weed killers, and any information you want on their application—by your own machine or by contract services.

Shell Weed Killer D

Contains 2, 4-D for the economical control of weeds in grass and cereals.

SHELL WEED KILLER M (Liquid or Dust), contains MCPA—for cereals, flax, linseed and grassland.

SHELL WEED KILLER W, a volatile petroleum distillate—for weed control in carrots, parsley, celery and parsnips.

SHELL WEED KILLER C, a soluble powder containing DNOC for a wide range of weed control in cereals.



SHELL CHEMICALS LIMITED
(DISTRIBUTORS)

Agricultural Division

12 Linden Park, Tunbridge Wells, Kent. Tel. 3440

Please mention the JOURNAL when corresponding with Advertisers



And the next subject is . . .

ADDED CEREALS

It's vegetable, with a trace of mineral

'Added cereals' one of the ingredients which your merchant includes with VITAMEALO Concentrate to complete the balanced ration. Nowadays they vary in kind according to supplies, but mainly they supply starch, fibre and a trace of minerals to the ration. This variability of supply makes it more important than ever to be sure that the Concentrate will provide all the known requirements for growth, production and health.

That is why it will pay you to make sure that the concentrate is the best.

Meet us at:	BRAINTREE
ESSEX SHOW	Stand No. T.177
June 7 and 8	
ROYAL COUNTIES SHOW	
June 21 to 24	Stand No. 285
ROYAL SHOW — OXFORD	
July 4 to 7	Av. 13 Block I
Stand No. 454	

Write for full range of literature including "The Story behind Vitamealo"—free from Dept. M.L.

AGRICULTURAL FOOD PRODUCTS LTD.

23, Upper Mall, Hammersmith, London, W.6.

Northern Branch, Saltney, Chester.

Vitamealo



ENGLAND'S BEST CHICKS

THE "STANDARD"
SET BY



TURNEY BROS.

QUINTON GREEN, NORTHAMPTON
TELEPHONE : ROADE 220

Please mention the JOURNAL when corresponding with Advertisers

By Appointment
Seedsmen to



H.M.
The King

**DUNNS FARM SEEDS
LTD.**

**SEED SPECIALISTS
SALISBURY**

Scientific Adviser :
**Sir R. GEORGE STAPLEDON,
C.B.E., M.A., F.R.S.**

Crop Adviser for Scotland :
Mr. WM. H. FINDLAY, M.B.E., B.Sc., N.D.A.

PLough for Victory

and consult

The BOOK OF DUNNS FARM SEEDS 1950

Post free on application

Over 118 Years in the Service of Agriculture

Telephone—
Dunnsold, Salisbury

Telephone—
Salisbury 3247 (8,9)

DON'T WAIT FOR THE APHIS . . .



Pestox 3, the new systemic selective aphid killer can give you a healthy crop of Brussels Sprouts.

Being absorbed by the plant, Pestox 3 lasts despite heavy rain; it spares the ladybird and ensures a clean sample of sprouts.

Pest Control can contract to spray Pestox 3 for you, or if you prefer, we can dust or gas your crop with Nicotine.

But don't wait until the aphid starts working—spray early.

**SAFEGUARD YOUR PROFITS
ON BRUSSELS SPROUTS**

BY SPRAYING EARLY WITH

the new systemic selective insecticide

PESTOX 3

PEST CONTROL (U.K.) LTD. of CAMBRIDGE

Tel: MADINGLEY 3128



**Jack
BARCLAY**
LTD.
The Largest Official Retailers of
ROLLS-ROYCE & BENTLEY
Stock List of Used Cars on request.

Showrooms: Hanover Square, London, W.1. MATtison 7644
Service Works: Lombard Road, Merton, S.W.19. Lilliby 7228

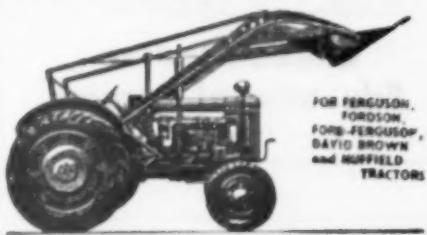


ONE MAN CAN LOAD 12 TONS IN 20 MINUTES

One man can dig the muck out of a yard, lift it and load it without leaving the tractor seat. He can lift, carry and load sacks of corn, bags of hay or straw—single-handed. The well designed Horn-draulic, powered by the tractor's hydraulic system quickly put on or taken off, lifts half-a-ton eleven feet and needs no maintenance. Over 250,000 Horn-draulics are in use in Britain and America. Prices with timed muck-bucket £70. Additional working attachments extra.

WITH THE

Horn-draulic LOADER



FOR FERGUSON,
FORDSON,
FORD-FERGUSON,
DAVID BROWN
and HUFFIELD
TRACTORS

STEEL FABRICATORS (CARDIFF) LTD., ROATH, CARDIFF. Tel. 44436

Please mention the JOURNAL when corresponding with Advertisers



MIRACLE OF THE MILLIGRAMME

A PINHEAD of iodine can mean all the difference between a healthy cow in full milk and a lifeless carcass. Did you know that only 200 of the 600,000,000 milligrammes a cow weighs must be iodine or the animal cannot live? One part in three million!

Goitrous swellings are the most easily recognised signs of iodine deficiency, but sterility, stillbirths and low milk yields are more common, and more costly.

For advice on the feeding of iodine to prevent deficiency and on iodine methods for treating goitre, mastitis and many other diseases, write to the Chilean Iodine Educational Bureau. Copies of handbooks published by the Bureau and the advice of its consultants are available without charge.

SOME RECENT PUBLICATIONS
IODIZED MINERAL SUPPLEMENTS
GOITRE IN ANIMALS
IODINE ON THE FARM
MASTITIS
PLANT PROTECTION

Ask that iodine you will be sent free

Chilean Iodine Educational Bureau

26, STONE HOUSE, BIRMINGHAM, LONDON, E.C.2

"D.R.W. TRADE MARK"
D.RON-WAL Supreme SPRAYERS and SYRINGES

For ALL PURPOSES OF PEST CONTROL

TREES.
GROUND CROPS
CATTLE
MALARIA
ETC., ETC.

No. 1054 DRONWAL WINNER POWDER BLOWER

Reg. No. 839849 Pro. Pat. 146
2 lb. capacity container

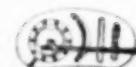
No. 4
LIME
WASHING
MACHINE



No. 1 KNAPSACK SPRAYER

A popular and easy type to operate, fitted with patent pump.

Complete
list on
request



Showman Cam
★ New Improved
Cam Operated
Patent No. 686771-49

From Ironmongers, Seedsmen,
Implement Dealers, etc.



The PHILIP B. WALDRON CO. (A.J.)
KINGS ROAD : TYSELEY : BIRMINGHAM

potato blight ★ and other fungus diseases

★ CONTROL and PREVENT
BY SPRAYING WITH
**BORDEAUX
MIXTURE**

The mixture should only be
made with the best quality

SULPHATE OF COPPER
Guaranteed 98/100%

SULPHATE OF COPPER
is also most effective in killing the mud snail which
carries the

LIVER FLUKE

**BRITISH SULPHATE OF COPPER
ASSOCIATION LTD.**

1 GT. CUMBERLAND PLACE, LONDON, W.1

*Grams
*Britishup, Westone, London

Phone:
Paddington 5068/9

Please mention the JOURNAL when corresponding with Advertisers

THE JOURNAL OF THE MINISTRY OF AGRICULTURE—*Advertisements*

FARMING THROUgHOUT THE WORLD



Switzerland is famed for scenery, snow and for its particular breed of goats which are extremely hardy and give high milk yields. No doubt the goat's well-deserved reputation for eating anything and everything arises from the fact that it has to search for its food in the high Swiss pastures.

In BRITAIN....it's



A FEED FOR EVERY NEED

J. BIBBY & SONS LIMITED · LIVERPOOL · 3

6/1947D

Please mention the JOURNAL when corresponding with Advertisers

Fertilizers pay!

FARM experiments carried out in this country prove that money properly spent on fertilizers pays worthwhile dividends from increased crop yields, both arable and grass*



For example POTATOES

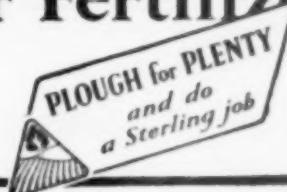
This crop on dunged land, gives an average increase in yield of 3 tons per acre from the use of 10 cwt. per acre of Fisons No. 1 Compound Fertilizer.

	£	s.	d.
Value per acre of additional crop	27	15	0
Cost of 10 cwt. FISONS No. 1	5	7	3
Increase return per acre	22	7	9

FERTILIZERS ARE A PROFITABLE INVESTMENT

It's Fisons for Fertilizers

Head Office:
HARVEST HOUSE • IPSWICH



Please mention the JOURNAL when corresponding with Advertisers